Vol. 33 Parts 1-2.

Rubber Research Institute of Ceylon

Combined 1st & 2nd Quarterly Circulars for 1957

July, 1957

Rubber Research Institute of Ceylon

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Those who wish to visit the Institute are requested to do so after making an appointment. No special days are set apart as Visitors' Days and the services of the technical officers can be availed of for discussion or demonstration only by prior appointment.

PUBLICATIONS

Rubber Research Institute publications comprising Annual Reports, Quarterly Circulars and occasional Bulletins and Advisory Circulars are available without charge to the Proprietors (resident in Ceylon), Superintendents and Local Agents of rubber estates in Ceylon over 30 acres in extent. Advisory Circulars and Small holdings Leaflets in English or Sinhalese will be available without charge to Smallholders on application. Forms of application can be supplied on request.

It will be appreciated if subscribers will return any back publications which are of no use to them.

ADVISORY CIRCULARS

The undernoted Circulars may be obtained on application at 30 cents per copy. Future issues in the series will be sent free of charge to estates and smallholders registered for the receipt of our publications:—

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THE RUBBER RESEARCH INSTITUTE OF CEYLON ITS ORIGIN AND DEVELOPMENT

By

E. D. C. Baptiste.

The Rubber Research Institute of Ceylon originated in 1909 as a Committee consisting of members of British plantation interests who agreed to contribute to a Scheme which would provide advisory and research facilities for the rapidly growing rubber plantation industry, the planted acreage of which had then reached an extent of about 200,000 acres.

The first meeting of the Executive Committee of the Scheme was held on 19th October, 1910, at the Chamber of Commerce in Colombo when it appointed a chairman and nine other members. An Analytical Chemist, Mr. L. Bellario, was the first Scientific Officer appointed and he was stationed on Hanwella Estate to work on problems of rubber manufacture and later on Gikiyanakande Estate in the Kalutara district.

The Scheme was reorganized in 1913 when it became known as the Ceylon Rubber Research Scheme and was financed by the Government of Ceylon which provided 60 per cent. of its income and the balance of 40 per cent. was provided by subscribers to the Scheme.

At the same time arrangements were made to instal an experimental vulcanizing plant at the Imperial Institute, London, and the reorganized programme of work on Gikiyanakande Estate was entrusted to a chemist, Mr. L. E. Campbell.

In 1914 the Rubber Growers' Association of London established in Ceylon The Rubber Growers' Ceylon Research Fund with headquarters on Culloden Estate, also in the Kalutara district, and with Mr. K. G. Marsden as Scientific Officer. This rival research establishment was amalgamated in 1920 with the Ceylon Rubber Research Scheme to which a year later the Rubber Growers' Association handed over its laboratories and staff bungalows on Culloden Estate.

The Chemist appointed in 1921 was Mr. T. E. H. O'Brien, who was later to become Chief Technical Officer and, in 1932, Director of Research.

The Ceylon Government continued to pay 60 per cent. of the cost of running the Scheme and the funds were administered by a co-ordinated committee, the first chairman of which, the Director of Agriculture Mr. F. A. Stockdale, was appointed on 16th August, 1922.

From that time onwards there was a considerable increase in the scope of activities of the Rubber Research Scheme resulting in the lease, in January, 1926, of 65 acres of land now part of the Nivitigalakele Station, for the planting and testing of clones and in developments in other directions.

This increased development led to the incorporation on 1st August, 1930, of the Rubber Research Scheme under the Rubber Research Ordinance No. 10 of 1930, which provided for the collection of an export duty of one-eighth of a cent on every pound of rubber exported from Ceylon, the funds to be utilised foı research work on rubber and to be administered by a Board of Management.

Voluntary subscriptions then ceased and the Executive Committee of the old Rubber Research Scheme at a meeting held in Colombo on 24th October, 1930, adopted the resolution "that the entire assets, liabilities and staff of the old Rubber Research Scheme be offered to the Board of Management of the new Rubber Research Scheme, with effect from August 1, 1930, the date on which the Rubber Research Ordinance came into operation."

This resolution was unanimously confirmed at a final General Meeting under the old organization held in Colombo on 26th March, 1931. The tenth Annual Report of the old Rubber Research Scheme, for 1931, became the first Annual Report of the new Rubber Research Scheme established under Ordinance 10 of 1930.

The new Rubber Research Scheme (Ceylon) agreed in 1932, to share with the Rubber Research Institute of Malaya, which was established in 1925 under the Rubber Research Institute of Malaya enactment, the support and use of its staff and laboratories at the Imperial Institute, London. The separate London Advisory Committee of Ceylon and of Malaya then amalgamated and the new joint Committee became known as the London Advisory Committee for Rubber Research (Ceylon and Malaya).

The Rubber Research Scheme continued to expand from 1932 up to the outbreak of the war in 1939 and during that time the experimental areas at Nivitigalakele were extended to 174 acres.

In 1934 the 178 acre Dartonfield Estate near Agalawatta was purchased and, under the able direction of Mr. T. E. H. O'Brien, the necessary offices, laboratories, experimental factory, staff bungalows, line rooms, were put up enabling the headquarters of the Scheme to be transferred from Culloden Estate to Dartonfield on 7th November, 1936.

The Smallholdings Department was established in April of the same year and put in the charge of Mr. W. I. Pieris, B.A. (Cantab), who had previously made a visit of two months' duration to Malaya to study the organization of smallholdings' work in that country.

In 1942 a lease of 1,000 acres of jungle land at Hedigalla in the Kalutara district was obtained for the purpose of expanding field experimentation on the testing of new planting material, manurial trials, soil conservation and disease control methods.

In 1951 the Rubber Research Scheme was officially styled the Rubber Research Institute of Ceylon under the provisions of Rubber Research (Amendment) Act No. 30 of 1951.

The writer, who is the fifth Director, is also, by the provisions of the Rubber Research (Amendment) Act No. 50 of 1953, the Vice-Chairman of the Rubber Research Board.

The Institute's headquarters on Dartonfield Estate comprise modern administrative blocks, laboratories, factory, workshops, with staff living quarters and amenities.

Suitable living quarters for minor staff and labourers are provided on each of the three divisions of Dartonfield Group, with schools, amenity halls, dispensaries, creches and bakeries at Dartonfield and Hedigalla.

The salaried staff at the end of 1956 numbered 143, consisting of 9 Senior Staff, 7 Intermediate Staff, 88 Assistant Staff and 39 Minor Staff.

Among the important contributions to the rubber industry for which the Institute may claim full credit, and which represent no mean achievement, may be mentioned:—

(*a*) the early development of Smoked Sheet manufacturing methods.

(*b*) the use of acetic acid coagulation.

(*c*) the use of sodium bisulphite in raw rubber manufacture.

(*d*) the development of the crepe rubber industry.

(*e*) the development of methods of estimation of rubber in latex.

(*f*) the control of Oidium leaf disease.

(*g*) the breeding and selection of high yielding Ceylon clones which stand comparison with the best material developed by other rubber research institutes in the Far East.

(*h*) the diagnosis in the field of deficiencies of the major elements of plant food and the successful application of remedial measures by the use of suitable and recommended fertiliser mixtures shown by long term manurial experiments to satisfy the needs of the rubber tree under Ceylon conditions.

(*i*) the determination both of rate of uptake and of total uptake of nutrients by rubber trees of all ages.

There are four technical departments, namely Botany, Plant Pathology, Agronomy and Chemistry, in addition to a Smallholdings Department, an Estate Department and an Administration Department and the three Experiment Stations of Dartonfield (147 acres), Nivitigalakele (169 acres) and Hedigalla (694 acres), with a total planted acreage of 1,010 acres of which 323 acres are in tapping.

The Botany Department is concerned mainly with the improvement and testing of planting material and with tapping problems. Of the clones developed by this Department since 1938 twenty-five have given in small scale trials yields of 20 lbs. or more dry rubber per tree per year and five of these selected clones have yielded 30 lbs. or more of dry rubber per tree per year.

The Plant Pathology Department deals chiefly with the prevention and treatment of diseases of the rubber plant. Oidium leaf disease is now controlled most effectively by sulphur dusting and attention is now focussed on the prevention and treatment of Phytophthora leaf and bark diseases and on the treatment of root diseases.

The Agronomy Department is concerned with the fertiliser requirements of rubber plants of a wide range of age, with the use of soil covers and with the control of weeds in rubber areas.

The Chemistry Department is engaged on investigations of manufacturing problems in estate factories and advises on the correct operation of factory

machinery, smoke houses and on the avoidance of defects in smoked sheet and crepe. Work is also being done on the effect of copper-containing fungicides and certain organic fungicides, used for the control of Phytophthora leaf disease, on the properties of latex and rubber.

The Smallholdings Department caters for all the needs of smallholders by advising on methods of planting, manuring, tapping, disease control and treatment, and manufacture. The Department has found a successful solution of the problem of a practical and economic sulphur dusting scheme for the control of Oidium on rubber smallholdings by the formation of co-operative groups in districts. The results of the successful trials carried out in 1955, 1956 and 1957 have made it possible to plan for a gradual extension of a sulphur dusting scheme for control of Oidium on smallholdings to cover over a five-year period almost the entire extent of economic rubber smallholdings in the island.

The tempo of work of this Department for the Rubber Replanting Subsidy Scheme and for new rubber planting continues unabated.

The Estate Department controls over 1,000 acres of experimental planting on the three stations of the Institute and is also responsible for the supply of budwood of Institute's and imported clones to estates. It has opened up and planted 139 acres of rubber nurseries for the Rubber Replanting Subsidy Scheme.

It is generally acknowledged that the Rubber Research Institute, which sprang from very modest beginnings, has justified its existence and there is no gainsaying that the economy of the Island would have been severely impaired had not the scientific staff found the effective means of commercially controlling the ravages of Oidium heveae which had spread over the whole rubber area and threatened the ruin of the rubber industry of Ceylon.

The Institute has since 1949 been maintained by a cess of 55 cents per 100 lbs. of rubber exported although its staff and activities have increased considerably since that time.

Plans for extending the research and advisory activities of the Institute on the basis of a five year plan submitted by the Rubber Research Board and which entail a substantial increase in the rubber research cess have been unanimously approved by the two main bodies representing the Industry, the Planters' Association of Ceylon and the Low Country Products Association, and representations made to Government for their implementation have been successful.

Research must be intensified if Ceylon is to keep her place in the forefront of rubber producing countries. The breeding of new high yielding clones resistant to the three major leaf diseases of Hevea caused by Oidium, Phytophthora and Dothidella is to be given top priority in the research programme. To this end plans for an exchange of clones with the Western Hemisphere and the engagement of a qualified plant breeder, with actual experience of Hevea breeding in Latin America, on an assignment of at least two years to organize a new department of plant breeding and to train Ceylonese personnel in this important line of production research aimed at lowering the cost of production per lb. of raw rubber have been approved by the Rubber Research Board.

The United States Department of Agriculture has agreed to the proposed exchange of clones between America and Ceylon and the assignment of a plant breeder to the Rubber Research Institute by the United States Operations Mission to Ceylon has been approved by Government.

Control of Phytophthora which causes leaf fall, branch dieback, bark canker and bark rot of the rubber tree and the incidence of which has recently been assuming serious proportions since the effective control of Oidium was brought about by sulphur dusting, will also be given high priority among the research projects of the Institute.

Manuring, tapping, weed control and manufacturing problems will continue to receive adequate attention.

The Smallholdings Department, from its manifold advisory duties to smallholders, will continue to devote a large portion of time and labour to the large-scale control of Oidium by sulphur dusting of economic holdings and to replanting work under the Rubber Replanting Subsidy Scheme.

The programme envisaged provides for an increase of Ceylonese graduate staff and assistant staff, of laboratory equipment and accommodation in all technical departments and also for the provision of suitable old rubber land for testing new clones under different conditions of soil and climate, for the proposed expansion of research and advisory activities of the Institute which have been restricted in the past owing to lack of funds.

In this connexion the proposed establishment of three substations, each of approximately 200 acres, on old rubber land situated in other rubber growing districts of the Island (Kegalle, Kelani Valley/Ratnapura and Galle areas) for the testing of new planting material produced as a result of the breeding and selection work carried out at the Institute and obtained from other rubber research institutes will be put into effect now that Government has approved a grant to the Institute of an interest-free loan of one million rupees for the purpose.

RUBBER RESEARCH INSTITUTE OF CEYLON

THE DRYING AND SMOKING OF NATURAL RUBBER

Part I.—The Design and Operation of Temporary Type Smoke-houses

By

E. J. Risdon,

(*Chemist, and the Staff of the Chemical Dept.*)*

1. Introduction:

Previous articles in this journal (and elsewhere) have included comments to the effect that the price differential between R.S.S. and blanket crepe is not necessarily constant on the Colombo market, and that certain Estates with only strictly limited factory capacity may have to consider rather carefully how the extra crops obtained as a result of replanting shall be processed. The comparatively recent revival of interest in cheap temporary type smoke-houses in Ceylon is usually attributed to one or both of the above considerations. The primary purpose of this article is, therefore, to pay a brief tribute to the constructional ingenuity shown by many of those connected with the Ceylon Rubber Planting Industry and to comment upon some of the commercially built temporary type smoke-houses with the object of emphasising, for the guidance of future builders and operators, some of the hazards and pitfalls etc. of this subject. The appearance of certain apparently adverse comments on any particular design should not be misconstrued, as the majority of the designs adopted fulfilled the purpose for which they were intended, *i.e.* the smoke-houses produced the appropriate quantity of R.S.S. for the appropriate length of time.

2. Functions of a Temporary Type Smoke-house:

For the purpose of this article temporary type smoke-houses are defined as smoke-houses, built with cheap material, whose useful life would not usually be regarded as lengthy, or less satisfactorily, as smoke-houses whose average annual repair costs might reasonably be expected to form an appreciable proportion of the low original capital outlay. On the basis of this definition temporary type smoke-houses might at present be expected to be economically worthwhile, and in some cases essential, in preference to the more expensive permanent type units under the following conditions:—

(*a*) When the capital necessary for a permanent unit is not available, or is available only at high interest rates, or when the capital available could be more usefully employed, *e.g.* for agricultural development.

(*b*) When the additional capital charge of a new permanent smoke-house is unlikely to be covered by protracted operation over a long period of time. (It is apparent that many Estate Managements consider the influence of the premiums paid by China for R.S.S. under this category).

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* M. T. Veerabangsa.

(c) When the available smoke-house capacity in the form of permanent R.R.S. type units is adequate for the average daily crop but is inadequate, even if modifications are made to use the bulking chamber for smoking, for the highest output periods, *e.g.* towards the end of the calendar year.

(d) Under certain circumstances, when the Estate is operated on a short leasehold or other temporary basis, or

(e) When a permanent unit is seriously incapacitated as a result of structural failure, *e.g.* due to fire etc., and no suitable alternative method of crop disposal is available.

Upto the present it has not generally been customary in recent years in Ceylon to regard the employment of temporary type smoke-houses as a permanent feature of factory policy. However, examination of some of the early literature seems to imply that many Estates outside Ceylon built their smoke-houses out of materials which would usually be considered unsuitable for permanent type structures in Ceylon. This observation together with the rather enthusiastic reports received from some operators of temporary type smoke-houses does suggest that Planting Companies might be well advised to consider rather carefully whether the use of temporary type smoke-houses should not become a permanent feature of factory policy, and, in particular, whether Estates, committed permanently to R.S.S. production or to a policy of flexibility of manufacture, should regard temporary type smoke-houses as a necessary part of any additional equipment and buildings required to process the extra crops obtained as a result of extensive replanting. Under these conditions the principal considerations will be the economic aspects of temporary type smoke-house construction and operation, and, while the necessary background data may be available to certain Agency Houses, the R.R.I. of Ceylon has insufficient first-hand experience of the commercial operation of temporary type smoke-houses to give any entirely valid guidance on this subject. The information offered to the writer by constructional engineering companies and by operators of the cheaper temporary type smoke-houses appears to suggest that in terms of fixed annual charges, which might be debited to the operation of smoking when the latter is considered as a unit process, the shorter life of temporary type smoke-houses may be more than counterbalanced by the higher initial cost of permanent smoke-houses. However, a larger annual saving in 'book' charges with temporary type smoke-houses may not be considered by the larger Estates, committed permanently to R.S.S. production, to be sufficient compensation for the unassessable risks of loss of crop and inconvenience resulting from unexpected difficulties, such as fires or premature structural failure, or for the possible additional labour charges arising from the use of a multiplicity of relatively small buildings often located at some distance from each other and from the milling and packing rooms. Nevertheless as implied by (a) above the low capital outlay required for temporary type smoke-houses may be attractive to R.S.S. Estates at a time when the initial, but not the later, replantings come into bearing. The implication here being that the provision of temporary type smoke-houses at the earlier stages of replanting would not be such a serious drain on reserves or capital required primarily for agricultural development, and that the experience gained would assist in formulating factory policy for periods when replanting expenditure might not be so heavy.

3. Basic Principles of Temporary Smoke-house Design:

The particular design selected at an Estate must necessarily comply with any peculiar local circumstances; but, in general, the basic requirements are that (a) the maximum % of R.S.S. 1 shall be produced in the minimum time with the minimum of labour and of fuel, (b) the constructional costs shall be as low as possible but shall

be consistent with adequate structural strength, flexibility and ease of operation and with insurance requirements and that (*c*) the risk of major fires shall be as low as possible, provided that the money and time available for construction permit the selection of a design where the risk of fires is relatively low.

The information available on the theory underlying the drying of R.S.S. has been described in some detail in the technical literature of the R.R.I. of Malaya *et al* (2, 7) and has been summarised rather briefly in recent publications of the R.R.I. of Ceylon (8). In general, the initial stages of drying are conducted under conditions where neither the temperature nor the relative humidity are allowed to rise beyond certain limits and the final stages of drying (zone of internal diffusion) are conducted under conditions where the temperature is raised. The influence of the relative humidity of the air in the buildings upon the drying rate during the later stages of drying is less precisely defined, but it is usually customary to assume that with conventional smoke-houses operated according to the official recommendations the effect of small changes in humidity can generally be ignored. [The significance of substantial increases in operating relative humidity will be discussed elsewhere]. In terms of commercial practice, the implication is that, ideally, temporary type smoke-houses would be expected to provide adequate but not excessive ventilation, possibly in the form of a positive upward draught of air and smoke and a suitable temperature gradient within the building, *e.g.* either uniformly cool on the lowest tiers of the racks, say, not above about 130°F beyond which the risk of blister or bubble formation in wet sheets of standard thickness cannot always be ignored, and uniformly hot on the highest tiers possibly as high as 135 to 145°F, or a uniform temperature throughout the whole space where sheets will hang. The restricting influence on possible temporary smoke-house designs of some of the basic theoretical requirements mentioned in this and in the preceding paragraph are discussed below.

The ventilation spaces recommended for R.R.S. type permanent smoke-houses —1 sq. foot of outlet space in the ceiling per 3,000 cubic feet capacity of the building and twice this area for the cold air inlets (6)—cannot necessarily be applied to all temporary type units, partly because no 'perfect' ceiling or true bulking chamber in the accepted sense is generally envisaged in the cheaper units, partly because the walls may be more porous at least in the initial stages of use and partly because the furnace, which is not generally in form of a firebox centrally located in a bulking chamber, must in many cases be considered as a distinct unit. In this connection it will be remembered that the conventional R.R.S. unit is usually built and operated in such a way that (*a*) much of the bulking chamber is in a state of 'under-pressure' and the floors of rubber in a state of 'over-pressure' in relation to the outside air, implying that unless there are abnormal conditions all the cold air enters through the bulking chamber only and minor imperfections in the walls of the smoking floors lead to loss of smoke rather than to the entry of cold air, and so that (*b*) there is a positive net upward draught through the building. However, in many of the unmodified temporary type smoke-houses, the design and method of operation originally adopted appeared to be such that the major part of the building was in a state of 'under-pressure'. This implied that the greater part of the cold air probably entered through either the roof or the walls with the possible production of cold spots in the building, depending upon the turbulence involved.

The structural materials used in contemporary Ceylon temporary type smoke-houses, *e.g.* wattle and daub, place an upper limit on the height of the building and thereby on the height of the racks, primarily because the data on the strength and reliability of the walls and foundations *per se* and on their ability to support a large roof is rather sparse. There is, of course, the additional point that sheet movement

is not always easy and rapid on tall racks; however, the major practical significance of the limitation of the height of the racks is that, unless the capacity of the smoke-house in terms of lbs. of R.S.S. per unit volume is to be quite low, the space utilised in R.R.S. type smoke-houses for 'bulking' purposes, *i.e.* the clearance between the lowest tier of reapers and the top of the furnace, must be substantially reduced. The uncertainty concerning the size of building which can be adequately heated by a single furnace, firebox or flue opening when the bulking space is limited, together with structural considerations, impose a limit to at least one of the ground surface dimensions, and it will be apparent that the more important differences between the designs of many temporary type smoke-houses can be regarded as different solutions to the problem of how to utilise the bulking space, found in R.R.S. smoke-houses, for smoking without at the same time grossly reducing the ground surface dimensions of the smoke-house. In this connection it will be remembered (*vide supra*) that many temporary type smoke-houses appeared to be designed to operate in a state of 'under-pressure' in relation to the outside air, so that any imperfections in the walls, particularly any imperfections low down on the walls near the corners away from the furnace, will tend to accentuate any tendency to cold spots in these areas as a result of inadequacies of design or operation. Theoretically, the objection of non-uniform temperature distribution at the level of the lower tiers can, under the appropriate conditions, be minimised by the use of a multiple furnace design or by any underground flue system. The former arrangement is employed in the Rambukkande units and the latter in the modified Helembe units. Of the two the underground flue system, particularly when operated with a positive upward draught, is expected to be more satisfactory in large sized units, but it is apparently appreciably more expensive to construct and is for this reason likely to be less widely used in Ceylon.

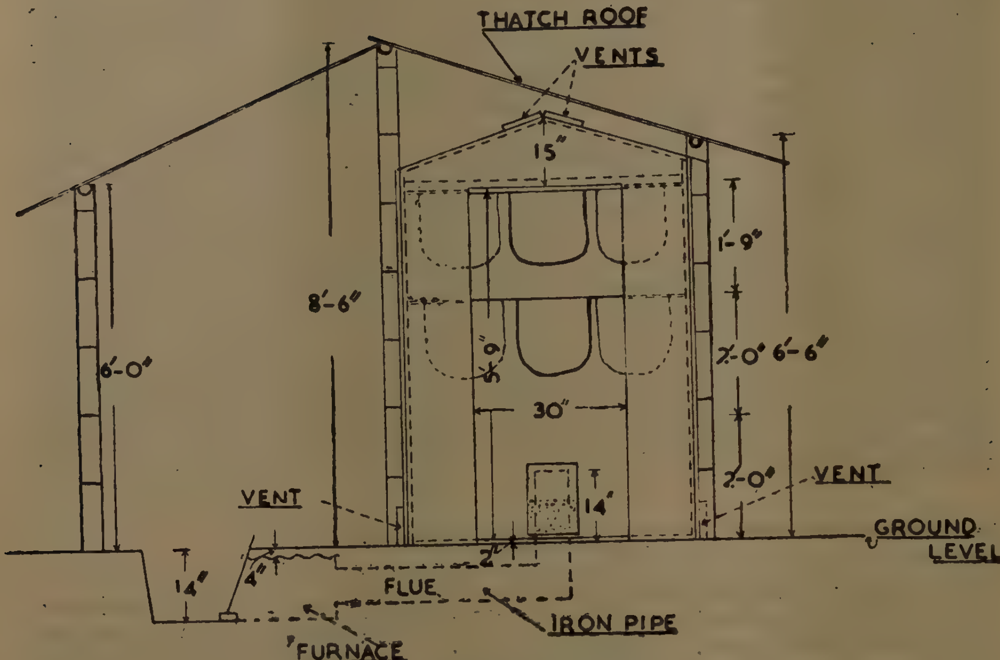
4. Village and Early Temporary Type Smoke-houses:

As many of present day temporary type smoke-houses have very obviously evolved from Village and small Estate units, it would be appropriate to consider these units in some detail. Smoke-houses suitable for small Estate and Village use and of capacities 170 and 256 sheets were examined and described by O'Brien in 1926 (5). These units have 8″ wattle and daub walls of the conventional Ceylon pattern with 6″ diameter jungle wood or other timber posts, the floors are of well rammed mud with side drains cut round the building and with earth thrown to the side of the walls to form a ramp. Suitably painted corrugated iron or tile roofing with either a boarded or hessian ceiling is included and provision is made for adequate ventilation in the form of adjustable flaps at the top and bottom of the walls. The present 350 lbs. and 800 lbs. capacity units, plans of which are usually available at the R.R.I. of Ceylon at Rs. 5/- each post free in Ceylon, appear to be similar in principle to these early smoke-houses. The 800 lbs. capacity smoke-house is built to ground floor surface dimensions of 15′ 6″ × 12′ 8″ (internal) and employs racks 7′ 6″ in height. It is to be expected, therefore, that conventional wattle and daub walls with jungle wood timbers would be quite suitable for buildings upto at least 15′ 6″ × 13′ × 10′. While this basic framework is likely to be structurally suitable for many Estates' temporary type smoke-houses, the internal arrangement of a central fire-pit, 2′ × 2′ × 2′, with a sturdy baffle plate mounted on angle iron bearers 3′ 6″ off the floor and of an overall 'bulking space' of 6′ between the lowest reaper and the floor is unlikely to be attractive due to the restricted number of tiers of reapers per rack. As noted in the previous section the designs recently adopted in Ceylon for temporary type smoke-houses represent in principle different solutions to the problem of how the bulking space may be employed economically and with reasonable safety for the smoking of sheet.

FIG. NO. 1.

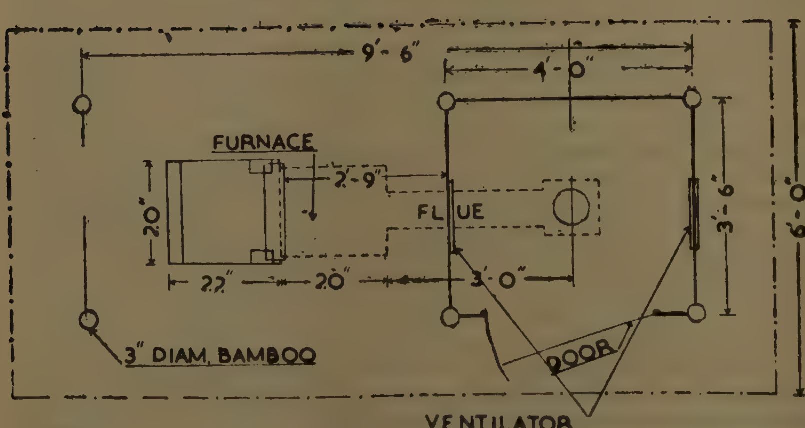
SMALL-HOLDERS' SMOKE-HOUSE

(MALAYA)



SIDE ELEVATION

FIG. NO. 2.

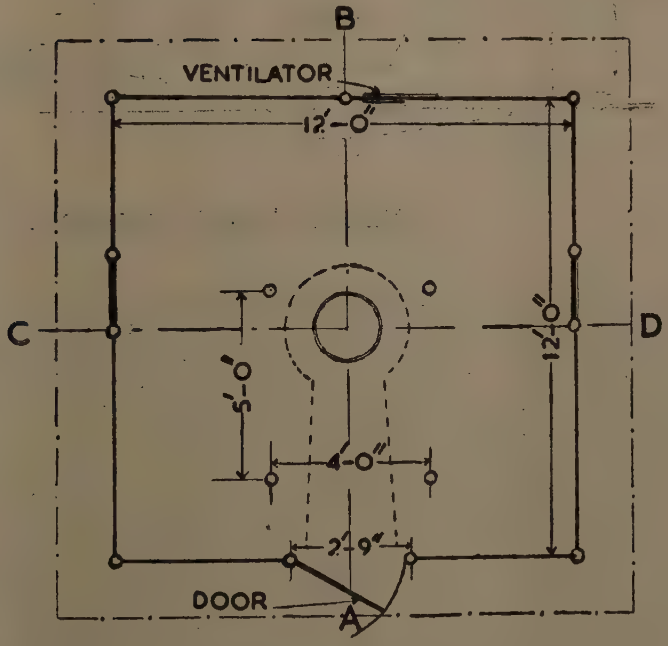


GROUND-PLAN

A Village type smoke-house used in Malaya was described (3) by Eaton of the R.R.I. of Malaya in 1935. The unit is intended to hold only 60 sheets and is by Ceylon standards extremely flimsy. The walls and roof are of gunny sacking (hessian) nailed to four upright bamboo posts. The walls may be treated with a mixture of cattle manure and clay or with sodium silicate and tapioca starch to render them less porous and more fire resistant. The hessian is not generally allowed to touch the soil and a sheet of tin or wood may be placed around the bottom of the walls. The unit which is only about 4′ × 3′ 6″ × 5′ 9″ (to the top of the highest reaper) is heated by an outside furnace with an underground flue and is protected from the weather by an attap roof and in certain cases by an allround protecting wall of attap. Side elevation and ground plan views of the unit are shown in Figures No. 1 and 2.

FIG. NO. 3

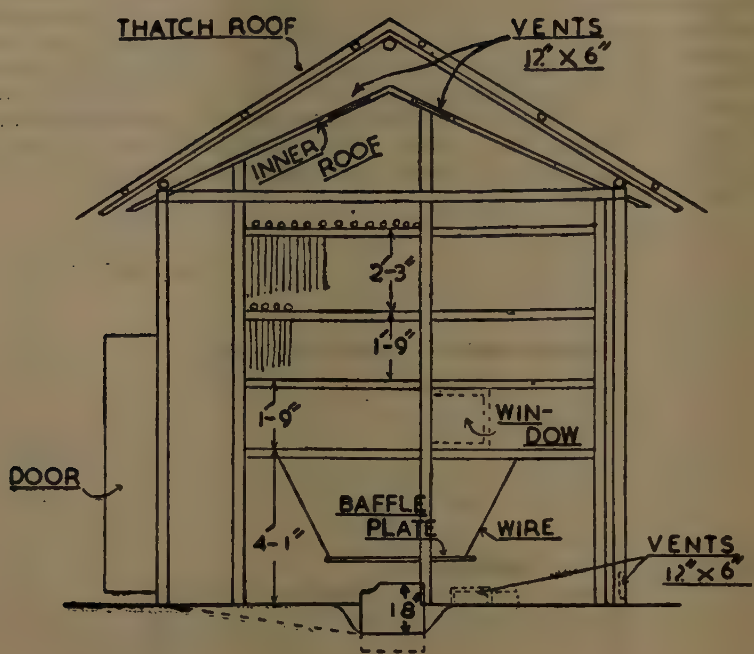
TEMPORARY SMOKE-HOUSE.
(MALAYA)



GROUND– PLAN

The unit mentioned above is obviously unsuitable for large and medium sized Estates and a temporary type unit on similar lines has been constructed in Malaya and is described in detail by A. Moore (4). This unit is approximately 12′ × 12′ × about 10′ to the top of the highest reaper and is reported to have a capacity of

FIG. NO. 4.



SECTION A. B. OF FIG. NO. 3.

about 1,600 lbs. The framework is of rough timber and the walls and roof are of split bamboo lined with strong paper or of sacking treated with tapioca starch. The smoke-house is protected by an outer roof of attaps and is heated by a single central firebox, cut from an old oil drum, over which is hung a corrugated iron baffle plate. A ground plan of the unit which is expected to last a year (possibly more) is to be found in the R.R.I. of Ceylon's Quarterly Circulars 1953 29 Parts 3-4 p. 116 and is reproduced with a sectional view in Figures No. 3 and 4. As far as is known this R.R.I. of Malaya type temporary smoke-house has not been reproduced in Ceylon presumably because such flimsy units are not generally considered an economic proposition under most Ceylon conditions. The similarity in the location of firebox and in certain other aspects of the basic design between this unit, the early R.R.I. of Ceylon village type smoke-house and the 800 lbs. smoke-house will have been noted and this design with more substantial constructional materials may be regarded as one solution to the problem of utilising part of the bulking space in, say, the 800 lbs. R.R.S. unit, *i.e.* the clearance between furnace and lowest tier of reapers is reduced to about 4′ with diminished surface dimensions of the building. However, even this modified unit does not appear to have been used recently in Ceylon partly because of the low capacity, but more probably on the grounds of the fire risk with an open internal central firebox or fire-pit and with diminished clearance between the sheets and the furnace. Alternative designs are considered in the next section.

FIG. NO. 5.

GALLAWATTA SMOKE-HOUSE

GROUND PLAN

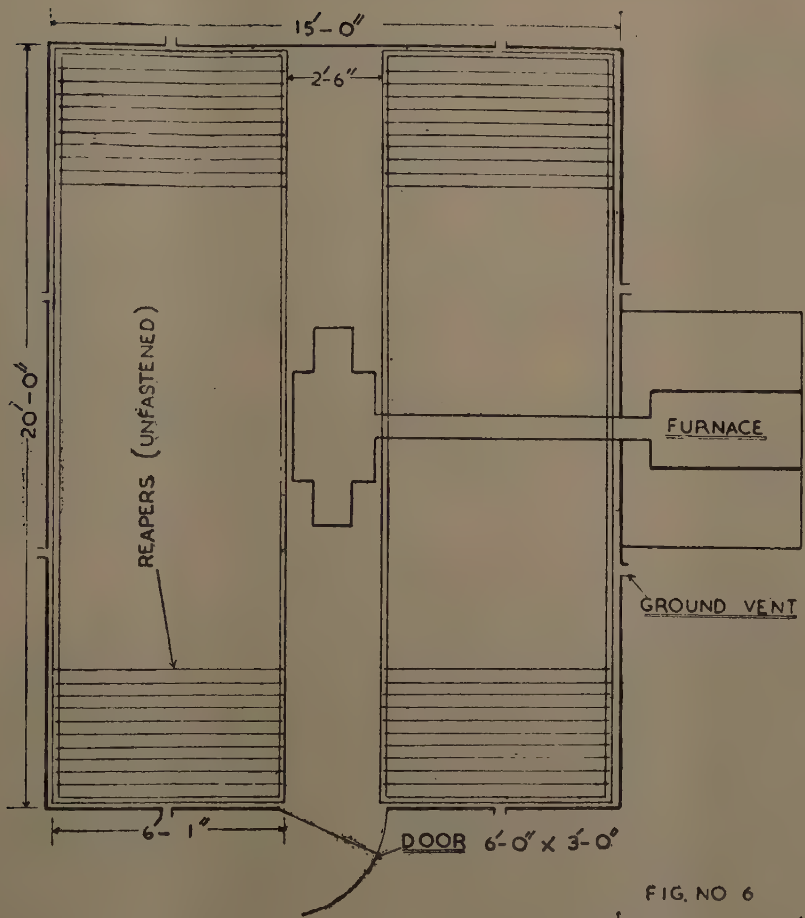
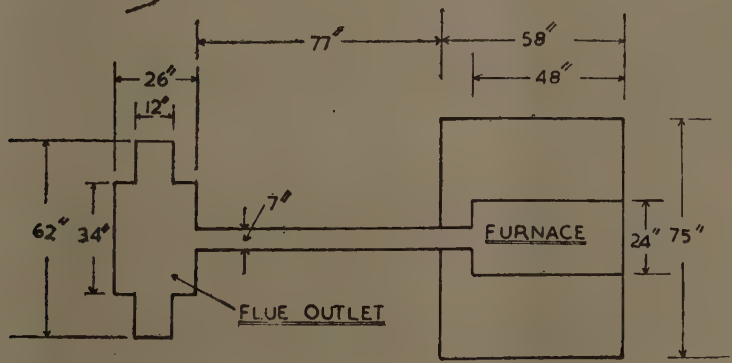


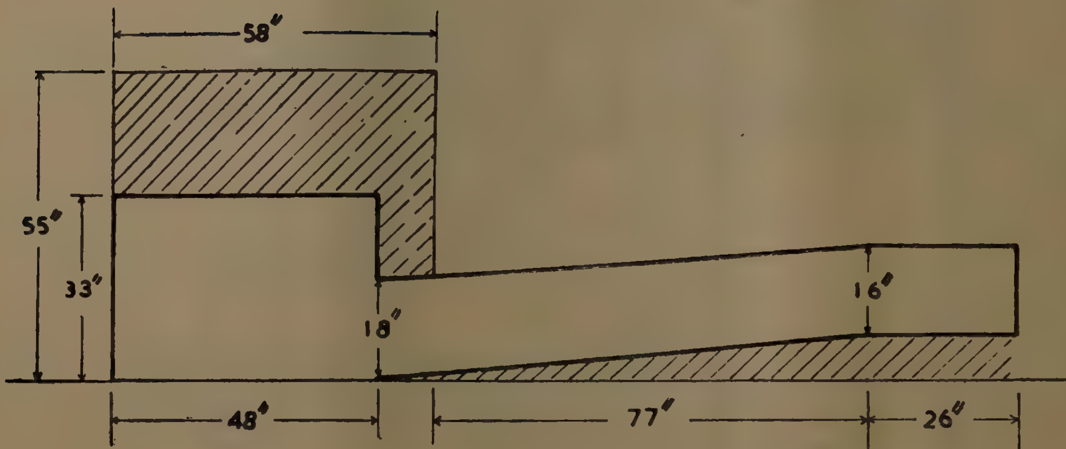
FIG. NO 6



PLAN OF FURNACE & FLUES.

FIG. NO. 7

SECTION THROUGH FURNACE & FLUES



5. Some Present Day Temporary Type Smoke-houses:

5.1. Gallawatte Type.—This smoke-house is a wattle and daub unit of dimensions approximately 20′ × 15′ × 11′ (to the eaves) and capacity approximately 4,560 lbs. of 1¼ lbs. sheet. The smoke-house is heated by means of a single outside furnace with a single flue opening in the central passage. This opening is covered by a heavy metal plate (boiler plate) raised off the floor. Ventilation is provided in the form of a number of holes near the bottom of the walls and of adjustable flaps in the ceiling. The outside walls are given a coating of cement mixture to decrease their permeability to air and to lessen the need for periodic additions of mud. Inquiries for fuller details of constructional costs etc. should be referred in the first instance to the Agents concerned, Messrs. Gordon Frazer & Co., Ltd., of P.O. Box 65, Colombo, to whom the R.R.I. of Ceylon is indebted for permission to examine the smoke-house. A ground plan and diagrams of the furnace are reproduced in Figures Nos. 5, 6 and 7. As far as is known the present normal method of operation for this smoke-house is to place wet sheets on the lowest tier and to move the sheets up usually one tier each day until they are dry or until they reach the top tier.

Examination of the temperature gradient found inside the building in the presence and absence of sheets very clearly suggests that at the level of the lowest tier the area near the centre of the racks, *i.e.* near the flue outlet, can be 10 to 25°F hotter than the area near the corners—the thermometers were placed 2′ from one wall and 4′ from an adjacent wall. At the level of the top tier (approximately 7½′ from the floor) the differences in temperature in this horizontal plane did not appear to exceed the range 0 to 6°F. Various experimental alterations were made to the ventilator settings and to the furnace but all attempts to make a substantial reduction

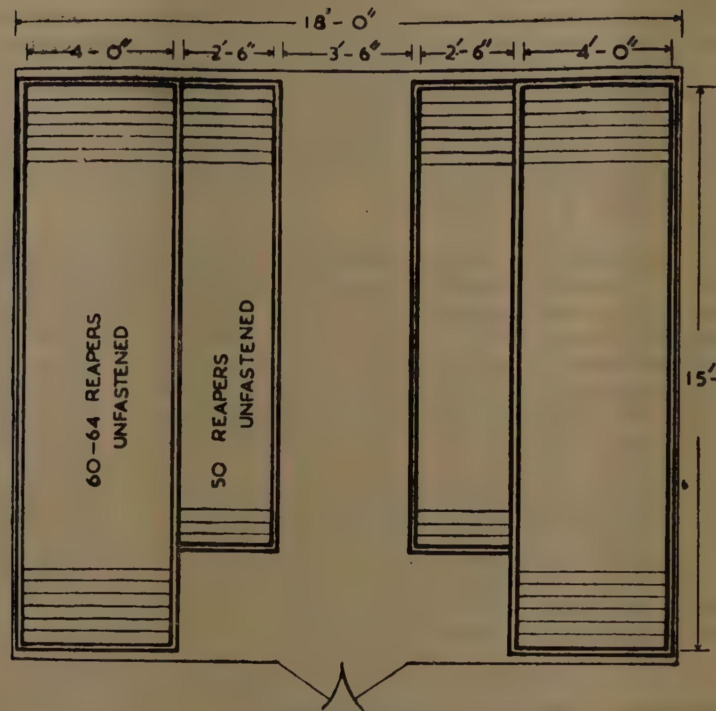
in the temperature differences at the level of the lowest tier failed unless the ventilation was very substantially reduced. These tests suggests that with units as large as 20′ × 15′ and with only about 35″ vertical distance between the flue opening and the lowest tier, a single centrally placed flue opening (with a raised baffle plate) or a single furnace is not the ideal arrangement from the viewpoint of temperature distribution, and it is understood that sheets smoked in the tiers near the door tend to require 1 to 1½ days longer to dry than sheets nearer the centre of the building. Alternatively, when sheets in the reapers near the door dry in the normal time there is likely to be blistering in the sheets near the flue opening. Presumably movement of sheet diagonally up the rack day-by-day rather than vertically would increase the uniformity of the drying time.

It will be apparent that in the Gallawatte temporary type smoke-house the question of how to employ the bulking space for smoking is solved by the use of an outside furnace with a single central flue opening, the lowest tier of reapers being approximately 35″ from the floor. It will also be apparent that from the viewpoint of temperature uniformity in a horizontal plane low down in the smoke-house, this solution is, in our opinion, not entirely satisfactory and that with the surface dimensions employed reasonable temperature uniformity may not be attained below 5′ to 8′ from the floor. The commercial, as opposed to the theoretical, significance of these points can, however, be overemphasised very easily as the appearance of a marked but not too large temperature gradient in a horizontal plane usually implies only that the effective daily capacity of the unit is slightly less than expected and that at least reasonable care must be taken to avoid blistering. In fact, this smoke-house has two obviously attractive features—firstly, no sheets hang immediately over the flue opening, and secondly the furnace is external—and could, in our opinion, probably meet the criticisms implied above by the introduction of a number of branch flues possibly with a slight enlargement of the present main flue.

5.2. Helembe Type.—This smoke-house, which was originally built and operated in late 1953 by G. E. B. Gottelier at Helembe on behalf of Messrs. Lee, Hedges & Co., Ltd., of P.O. Box 84, Colombo, the Agents for the Vogan Tea and Rubber Co., is a double smoke-house of external dimensions approximately 38′ in length and 17′ in width, divided by an internal wall into two compartments of internal ground surface dimensions 18′ × 16′. The walls of the building are of the conventional wattle and daub (except that 10% Atlas 'A' compound may have been incorporated into the daub), laid on rubble cement foundations with provision for a damp-proof course. The arrangement of the racks in the herring-bone unit is indicated very approximately in Figure No. 8 and on this basis the total capacity of both compartments, in terms of 1¼ lbs. sheets, would be expected to be slightly over 5,000 lbs; when the smaller racks are removed, the corresponding capacity would be expected to be about 3,600 lbs. Both compartments are fitted with flat ceilings. Shortly after the completion of these ceilings the Estate contacted the writer concerning the suitability of a single conventional internal small furnace pit for each compartment and was advised that, with units as large as 18′ × 16′ already fitted with flat ceilings, a system of underground flues with openings beneath the racks in conjunction with a plurality of small adjustable exit vents in the flat ceiling and with an outside furnace might be most suitable. The arrangements finally adopted by the Estate are illustrated in Figures No. 10 and 11 and, in general, the herring-bone type flue system depicted in the diagram on the left of Figures No. 10 and 11 is the arrangement in mind when reference is made to the Helembe smoke-house. Both compartments are based on the use of a single narrow but long internal underground furnace with a sloping floor and a flat roof which is at present partially supported by metal beams not shown in the diagrams. The branch flues leave the furnace at various points near the top of the furnace walls and the location of the

FIG. NO. 8.

HELEMBE (DOUBLE) SMOKE-HOUSE



GROUND PLAN OF RACKS.

ELEVATION OF RACKS

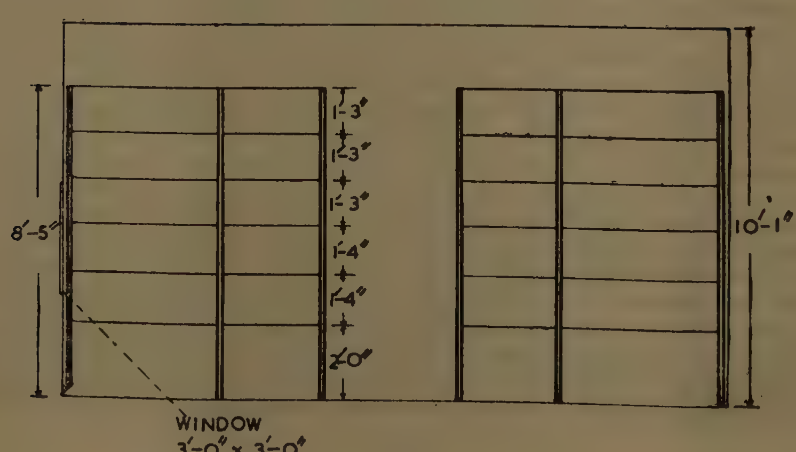
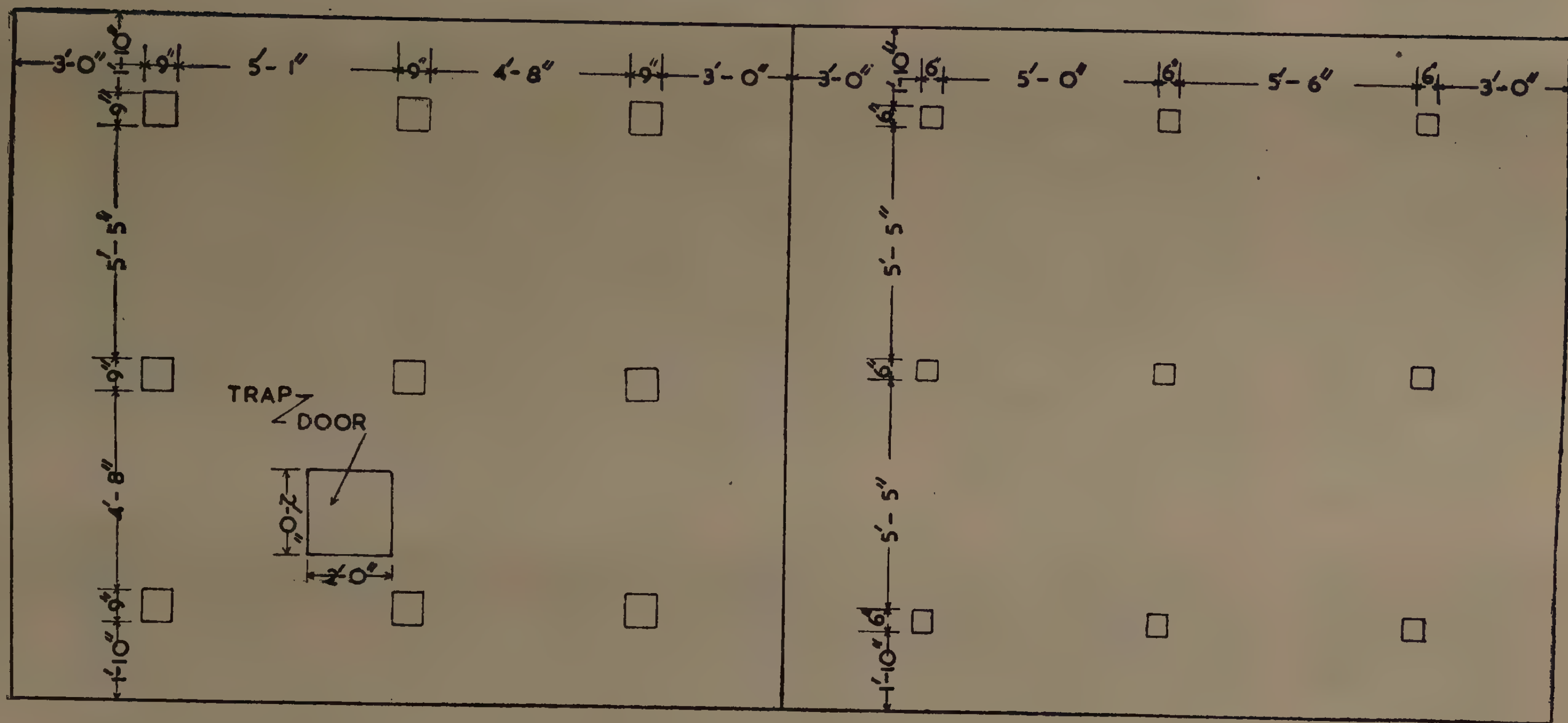


FIG. NO. 9.

POSITION OF VENTS ON THE CEILING



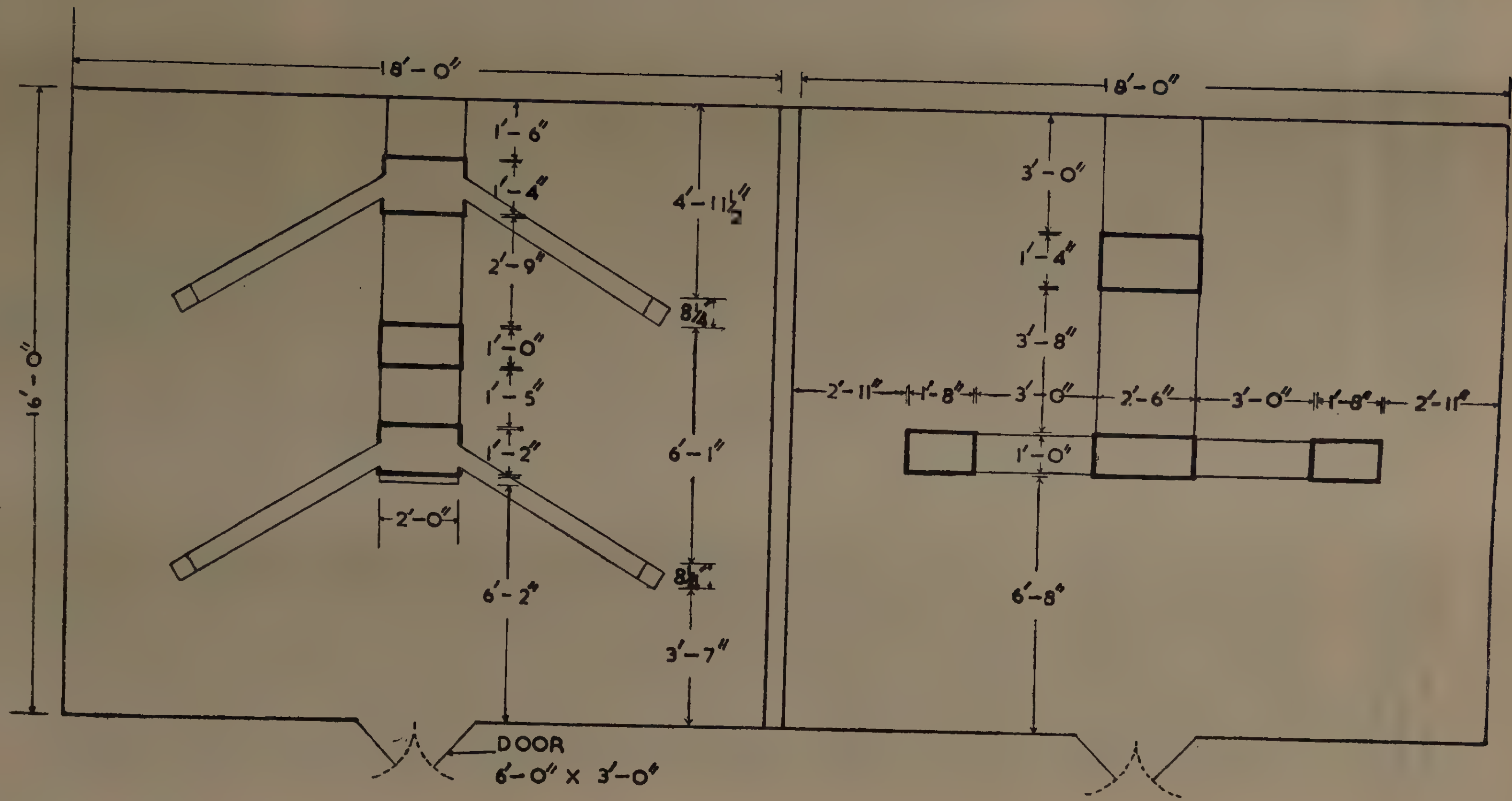
smoke outlets on the branch flues and in the furnace roof is clearly shown in Figure No. 10. The openings in the central flue are in the form of small holes in the furnace roof and the earth floor is sealed in place around the openings by a liberal application of wet cow dung. The flue openings in the floor and the exit vents in the ceiling can and should be adjusted, for example by means of asbestos boarding, once the unit is in operation in order to obtain the optimum temperature distribution. The sides of the furnace are built from stone or road metal blocks and fire-bricks and the top of the branch flues from tagarams. The sides and base of the branch flues are lined with mud mixture.

Examination of the herring-bone compartment in commercial operation in early 1954 failed to show any evidence of an appreciable horizontal temperature gradient between different positions amongst the sheets. There was, however, a temperature gradient of upto about 10°F between the highest and lowest (cooler) tiers of reapers. This temperature differential is, of course, an advantage in so far that the wet sheets may conveniently be placed on the lowest reapers with the drier ones at the top thereby ensuring, as in the tunnel type smoke-house, that the temperature is adjusted according to the moisture content. With an average operating temperature not above 122°F near the top of the smoke-house, R.S.S. of standard thickness dried in 5—6 days without difficulty, and there was no reason to suppose that this performance could not be improved by a slight increase in overall temperature provided the behaviour of sheets immediately over the branch flue outlets was carefully watched with a view to adding cheap perforated smoke spreader plates etc. if required.

It will be apparent that in the Helembe type temporary smoke-house the question of how to employ the bulking space for smoking is solved by the use of a relatively simple underground flue network system, and from the viewpoint of temperature uniformity in a horizontal plane amongst the sheets, this system is, in our present opinion, quite adequate. It will also be noted that the underground furnace is, in effect, an integral part of the flue network and this raises the question of whether a sufficiently lengthy, deep and wide underground furnace lightly sealed on top with, say, thin perforated metal plate might not be quite satisfactory without the branch-flues. This system in mind in this case is very obviously a development of the conventional single central small pit or of the single flue opening (covered with a solid baffle plate) of limited dimensions. This system would be expected to be most effective when the distances between the sides of the furnace and the racks is limited, *i.e.* when the smoke-house is either small or multi-furnaced. A unit of this type has been constructed from disused lines on an Estate in the Kegalle District. In this unit each compartment has internal dimensions of about 17′ in length × 14′ in width with a central underground furnace, about 3′ 2″ deep × 3′ 6″ wide, covered with perforated flattened oil drums or other thin metal plate. The furnace runs down the centre of the compartment parallel to the longest sides and is about two-thirds of the length of the compartment. The three racks are arranged in the form of an inverted right-angled ⊔ around the furnace roof. A brief examination of this unit in commercial operation showed marked and variable temperature difference amongst the sheets in a single horizontal plane at the level of the lower tiers of reapers. The particularly high temperature found amongst the sheets on the lower tiers near the area in which the logs were located markedly influenced the temperature gradient in a vertical plane at this area (implying under normal operating methods either the risk of blisters or bubbles at this area or prolonged drying elsewhere). Even when this temperature was reduced by the judicious use of tagaram strips, marked and variable temperature differences in a horizontal plane still appeared to exist. In general, therefore, it has been concluded that even this

FIG. NO. 10.

GROUND PLAN OF FLUES & FURNACE



type of unit would be rather more reliable with a limited number of branch flues. However, as with the Gallawatte type, the commercial as opposed to technical significance of the previous sentence should not be overemphasised.

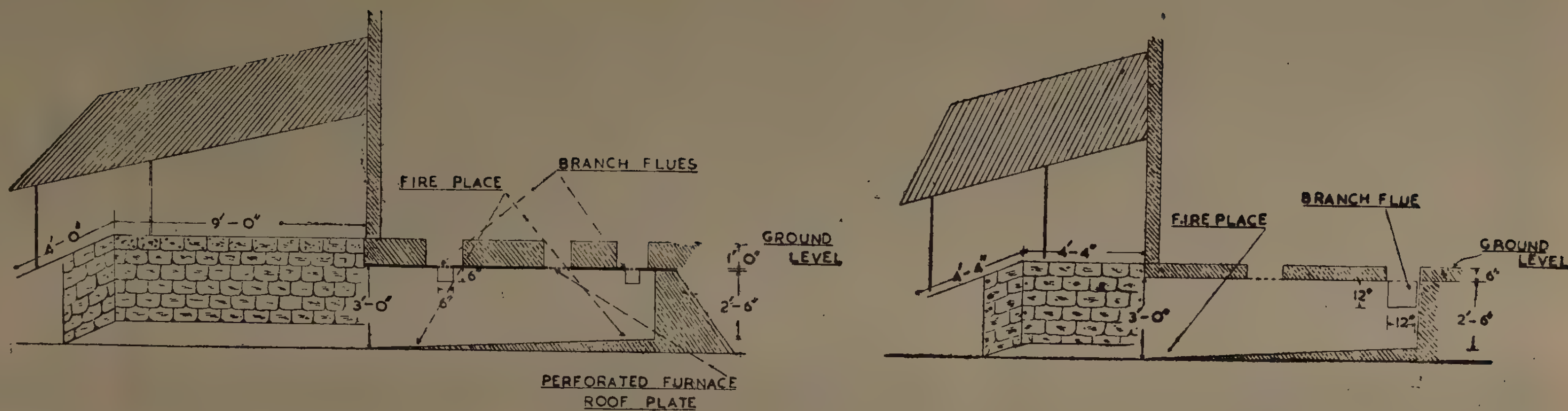
While it is our present opinion that method adopted at Helembe to distribute the smoke amongst sheets in the 'bulking space', *i.e.* a flue network system, is essentially adequate, this smoke-house as depicted in Figures Nos. 8 to 11 is not without certain commercial objections, *e.g.* high initial outlay, furnace roof warpage, overcombustion of the smoke, etc., which have become apparent during its two to three years of life. While all these objections are not entirely valid it is probably desirable to discuss certain of them in some detail as there are in Ceylon an appreciable number of temporary and modified permanent type smoke-houses whose designs bear an obvious and possibly accidental similarity to the Helembe type or whose designs, largely by the R.R.I. of Ceylon, incorporate many of the more valuable features of the Helembe smoke-house.

The major commercial objection to the Helembe smoke-house as a true temporary, rather than as a semi-permanent, unit is almost certainly the high initial outlay. Figures supplied in 1953 and 1954 (by the Estates concerned) for cadjan roofed units imply that, whereas a double Helembe smoke-house could not be constructed for less than about Rs. 1,550/-, Rambukkande type smoke-houses (*vide infra*) or suitable modifications of their basic design of approximately equal total normal capacity could perhaps have been built for Rs. 300/- to Rs. 800/- less, depending upon the width of sheets and the particular modification employed. The major portion of the estimated additional cost, in terms of initial outlay per lb. of total capacity, can almost certainly be largely accounted for by the larger number of tiers per rack at Rambukkande (7 v 6 at Helembe) and by the high cost of the somewhat unsatisfactory furnaces and of the substantial ceilings at Helembe (estimated by the Estate at about Rs. 300/- and Rs. 275/- respectively). However, the majority of the Helembe type units available in Ceylon—and, indeed, the majority of all recently built Ceylon Estate temporary type smoke-houses—should really be classified as semi-permanent rather than as temporary type smoke-houses on the grounds that the life expectation attached to the main framework of the building is often regarded as upwards of ten years. Based upon information supplied by certain Small-holders, this estimate for the life of a properly constructed and maintained wattle and daub unit may well be conservative. Under these circumstances too much importance can quite readily be attached to small differences in initial outlay and too little importance given to technical details, such as flexibility of operation or of design in terms of under or overloading with or without appropriate modifications of the unit. In this connection mention must also be made of the probability that both the furnace and the ceiling can be appreciably cheapened; the furnace by a modification requiring less expensive roof materials, and the ceiling by, perhaps, a combination of (*a*) a small wooden ceiling ventilation flap beneath a portion of the roof with (*b*) hessian or sacking possibly treated with starch and nailed to the roof timbers.

The major structural difficulty of the two individual smoke-houses depicted in Figures No. 8 to 11 arises from the provision of internal underground furnaces which are rather narrow (2′ and 2′ 6″), not very deep (3′ tapering to 2′ 6″), and which are equipped with a sheet metal roof partially covered with an insulating layer of earth and supported on a limited number of metal beams embedded in the walls and spanning the furnace. The implication here is that even if overstoking is limited by a rigidly enforced system of firing 'little and often' and even if any excess of firewood is not unnecessarily bunched inside the furnace, there is an obvious risk of overheating inside the furnace leading to overcombustion of the smoke and to

FIG. NO. 11.

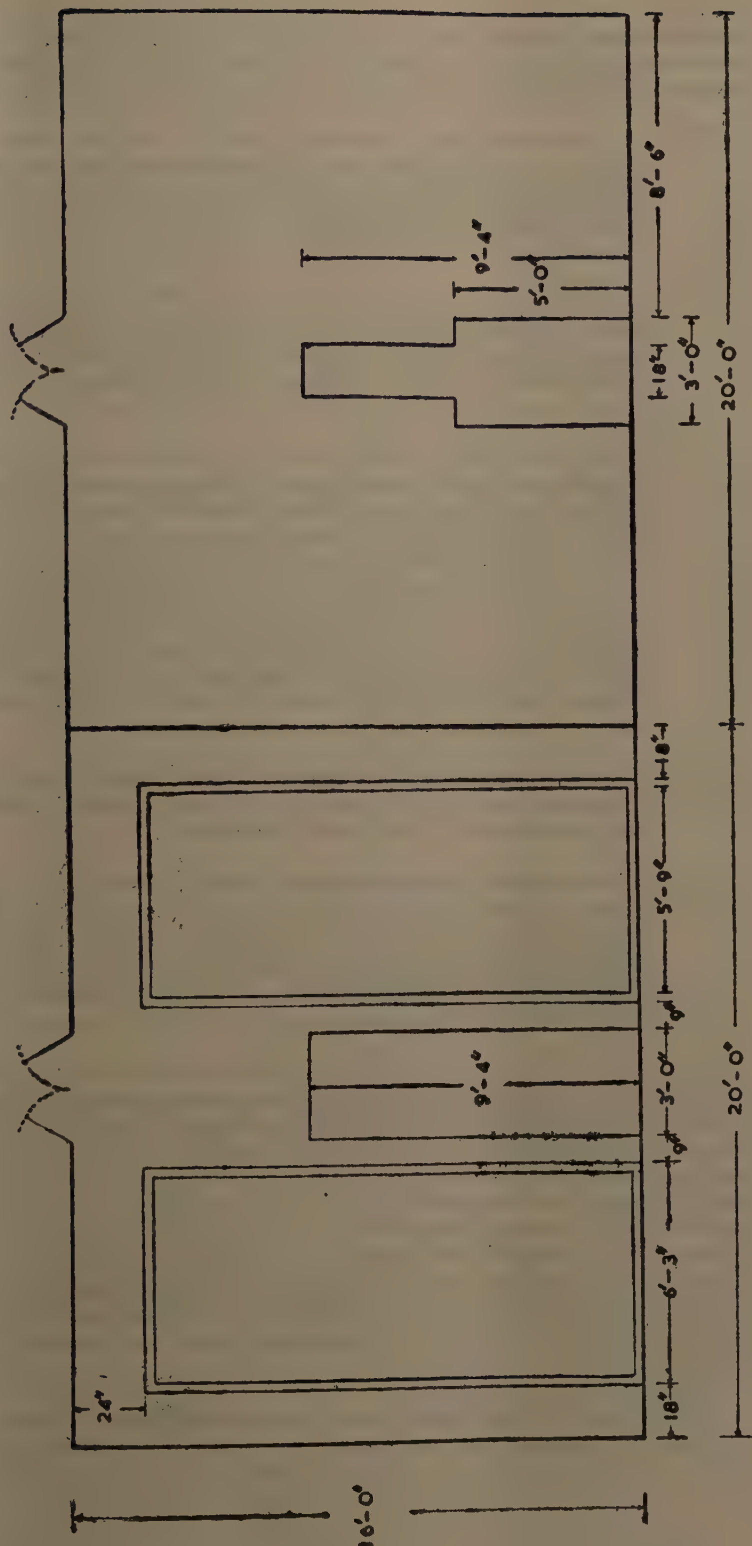
SECTION THROUGH FURNACE



warpage of the roof plate. Information supplied by interested Estates in the Kalutara District suggests that neither tagaram nor 7/32" thick plate is entirely suitable for the 2' wide furnace but that 7/32" thick plate can have a life of over two and a half years in the 2' 6" wide furnace, provided the furnace is examined and attended to where appropriate during each wintering season. At present the 2' wide furnace at Helembe is equipped with an expensive 17/32" thick roof plate. While the poor performance of the roof plates in the prototype Helembe temporary type smoke-houses might be due in part to poor quality material or to inappropriate operating techniques, it would seem advisable to ensure that units of this type when equipped with a partially insulated metal plate roof, should preferably be larger than 2' 6" wide and 3' in depth, should carry an adequately supported and reasonably thick metal roof plate (probably without too thick a layer of insulant) and should be correctly operated. Units built to the same basic design but with the relevant furnace dimensions on a more generous scale appear up to the present to have been rather more satisfactory in the respect of roof warpage even with quite thin uninsulated and perforated roof plates. In one of these units overstoking has been limited by placing the fuel in a truncated drum. As far as is known the possibility of using a larger Helembe type furnace with a roof based on concrete cannot yet be regarded as fully investigated, although limited temporary and modified permanent type smoke-houses using this system have been designed and operated commercially with the assistance of the R.R.I. of Ceylon.

Certain of the commercial objections and structural difficulties likely to be encountered with Helembe temporary type smoke-houses have been discussed above, and reference must now be made to what may at first sight appear to be serious operational difficulties. Firstly, Figure No. 8 shows that the arrangement of the racks in the prototype smoke-house is not conducive to rapid sheet movement by the labour and it may be appropriate to emphasise that the exact size and location of the racks in temporary smoke-houses built to this basic design should be adjusted according to the size and shape of the wet sheets made at the Estate concerned. Thus, even with sheets of wet width upto 22" it should be possible to build a double Helembe temporary type smoke-house, of capacity about 4,680 lbs. of, say, 1¼ lb. sheets and of about 5,000 lbs. of 1 1/3 lbs. sheets, according to the design indicated on the left hand side of Figure No. 12 where only 6 tiers of reapers are employed and where the internal dimensions of each unit are not above 20' × 16'. [The unit on the left hand side envisages the use of a furnace 3' wide and 3' 9" deep, branch flues not less than 12" in width and depth and racks located to give adequate working space between the racks and the walls, and is the arrangement in mind for both compartments. The furnace system in the unit on the right hand side is shown for reference only, as it illustrates with slight modifications an arrangement now being constructed experimentally by a commercial Estate. In this case the 3' wide furnace is terminated by fire stops 5' from the furnace face plate and from this point narrows to an 18" flue, the racks would be placed against the wall and enlarged slightly to give 4 sheets of 19" width per reaper and a total capacity of over 3,100 lbs. of 1¼ lb. sheets per compartment. The location of the branch-flues, which are not shown in either unit, is similar to that illustrated in the left hand side compartment of Figure No. 10 with the openings beneath the centre line of the racks]. Secondly, while it has been implied that the basic design used in Helembe smoke-houses permits a considerable measure of control in the distribution of the heat and smoke, the multiplicity of controllable variables, *i.e.* the location and amount of fuel required within the furnace, the direction of sheet movement and the size of the openings to be left (*a*) beneath the furnace face plate, (*b*) on the flue inlets into the smoking chamber and (*c*) on the ceiling vents, can readily confuse relatively unskilled Estate's staffs unless the principles involved are understood. Once the

FIG. NO. 12.



various control devices have been 'set' there is normally no need for further major alterations, and the notes tabulated below are intended as a rough guide to 'setting' the control devices:—

(*a*) In general the wet sheets are placed in the lower tiers of the racks and moved upwards as they dry. This is done so that wet sheets shall not drip onto dry ones and so that the dry sheets shall be in the hotter parts of the smoke-house. Normal dripping before insertion of the sheets into the smoke-house is recommended.

(*b*) In most cases an air entry gap can be left at the **base** of the furnace face plate (furnace door) in order to assist in the development of a slow net upward draught of air. Depending upon the design and location of the smoke-house, too large a gap may cause either a loss of smoke or unduly rapid combustion of the fuel.

(*c*) The smoke inlets into the smoking chamber on the roof of the furnace should not be fully closed down. On the assumption that the smoke and hot air from these inlets will not usually be reasonably evenly spread over the smoking chamber in a single horizontal plane below about 5′ to 8′ off the floor, this smoke is utilised to heat the upper tiers of the racks. If these inlets are closed down too much the wet sheet area may become too hot and if they are opened too wide the wet sheet area may be unduly cool and the sheets in the racks near these openings may blister. It will be apparent that the size of the openings on the branch-flues and on the furnace roof need to be balanced correctly if the proper temperature gradient and rapid drying is to be obtained.

(*d*) The rules concerning the openings in the ceiling vents are less definite but it is considered that in principle the vents above the furnace should not be opened quite so wide as the remainder.

(*e*) If the smoke-house is designed so that the racks are very close to the vertical plane of the central furnace flue openings it might be necessary to place pieces of clean (highly polished) tagaram against the side of the racks in this area to avoid blistering. As far as is known this is not generally necessary in conventional Helembe smoke-houses but is necessary in certain permanent smoke-houses modified for ground floor smoking.

It might be mentioned at this point that an arrangement whereby wet sheets hang above a substantially unprotected flue opening might be expected to be undesirable on the grounds of the fire risk involved. Upto the present, however, no cases of fires due to sheets tearing on the reapers and falling onto the perforated flue openings have been reported, and it seems likely that, provided the furnaces etc. and the reapers are not made too small, the temperature of the smoke leaving the branch-flue openings is insufficient to cause tearing and subsequent melting. However, as a precautionary measure, it is obviously preferable not to locate the lowest tier of reapers less than about 2′ 6″ above the branch flue openings. Where this clearance is less than 2′ 6″ in modified permanent type smoke-houses, coagulating pans have sometimes been suspended above the openings by means of wires from the reapers.

To summarize our present views, it is suggested that the principle employed in the Helembe smoke-house to utilise the bulking space of conventional R.R.S.

FIG. NO. 15.

(SINGLE) RAMBUKKANDA TYPE SMOKE-HOUSE (MODIFIED)

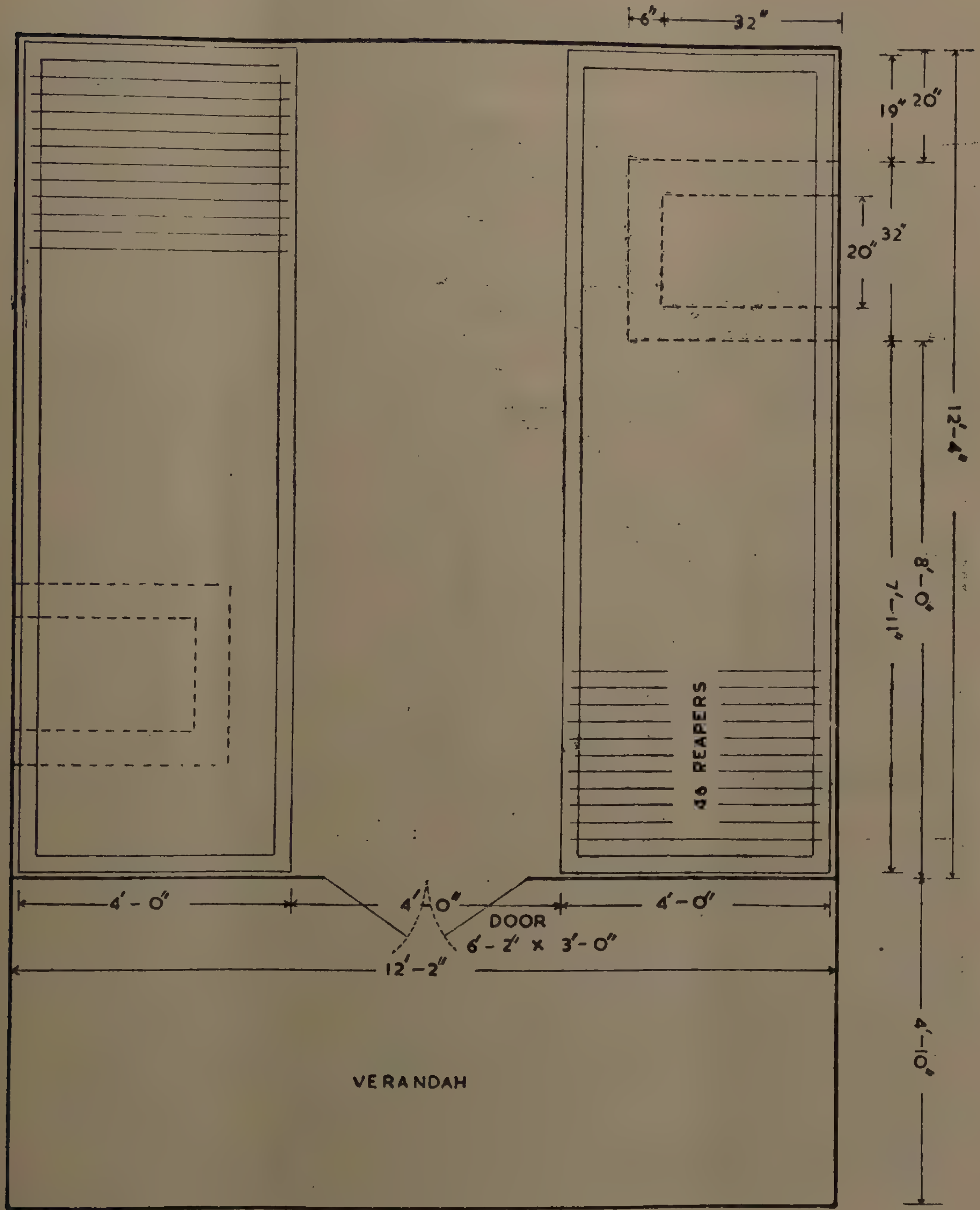
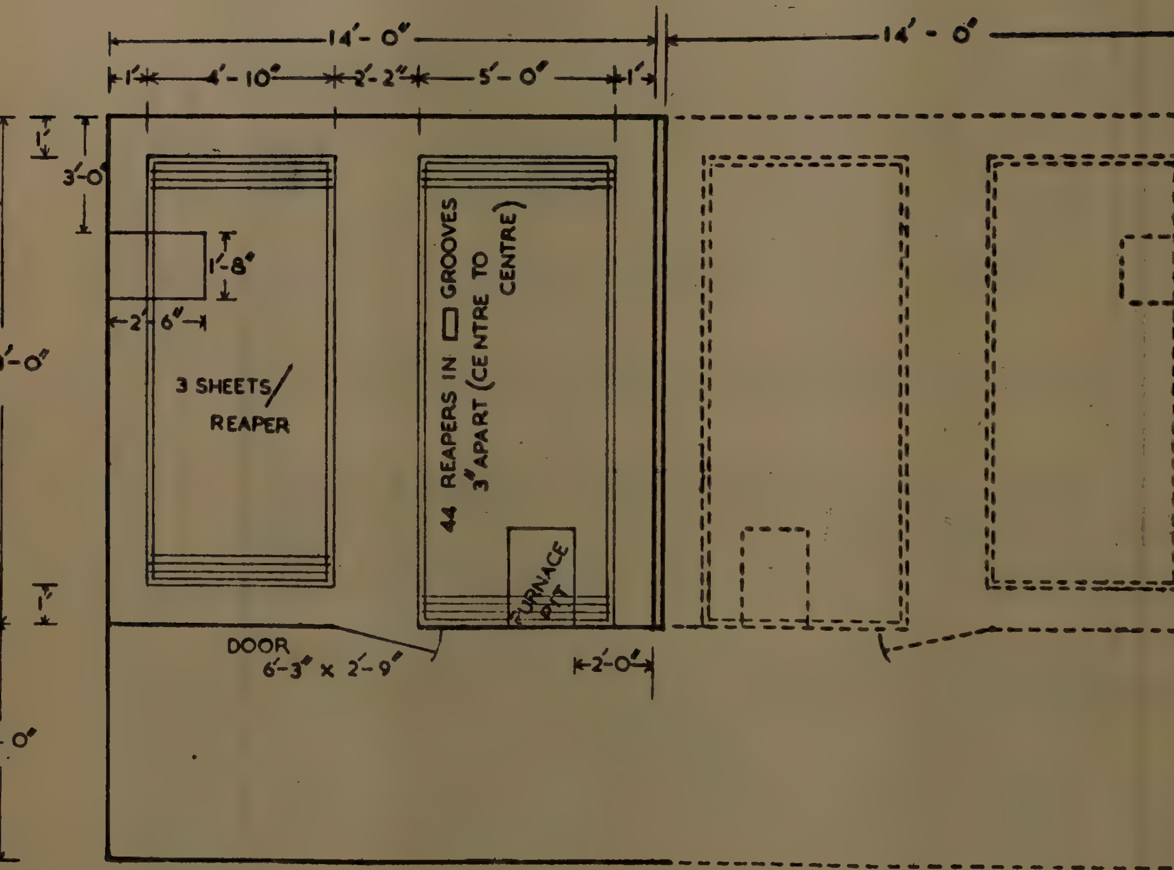


FIG. NO. 13(A

RAMBUKKANDA SMOKE-HOUSE
DALKIETH MODIFICATION

GROUND PLAN.



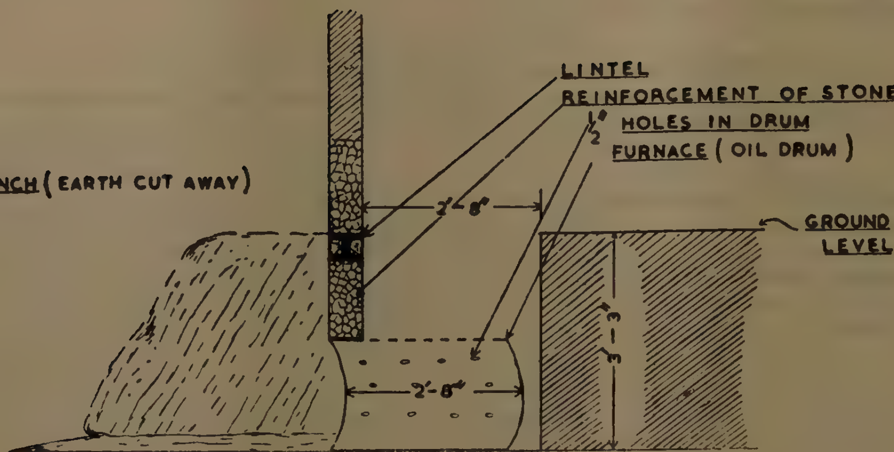
smoke-houses and to distribute the heat and smoke appears to be adequate. Considered as a true temporary type smoke-house, the criticisms that the (herringbone) prototype is unduly expensive to build and needs modification in the respect of the construction of the furnace do not appear to be unjustified. However, there is every prospect that the later and larger furnaces will be far more satisfactory and, considered as a semi-permanent type smoke-house, the criticism of high initial outlay carries rather less weight, especially if cheaper ceilings are employed. As the basis for the construction of larger semi-permanent type smoke-houses or of modified R.R.S. permanent type smoke-houses, the basic design, with relevant modifications, is obviously attractive.

5.3. **Rambukkande Type.**—The prototype of this smoke-house, which was built at Hapurugalla by B. Cocking, Superintendent at Rambukkande Group, is a conventional wattle and daub smoke-house of ground surface dimensions of approximately 12′ × 12′ with provision for 2 racks of 7 tiers of sheets on opposite sides of a central passage. Smoke and heat is provided by two internal furnaces (perforated, lidless oil drums, laid on their sides beneath the racks and largely submerged in a pit below the floor) on opposite sides of the smoke-house (*vide* Figures No. 13 and 14). The open or firing end of the furnaces is usually in a vertical line with the outside walls. The attractive feature of this type of smoke-house is its relatively low cost and the R.R.I. of Ceylon has been advised that a single unit with a working space of about 12′ × 12′ × 12′ has been erected with cadjan roofing for less than Rs. 400/-. The unit illustrated in Figures No. 13 (*a*), 14 (*a*) and 15 (*a*) is a larger double Rambukkande smoke-house referred to as the Dalkeith modification and, on the basis of 7 tiers per rack and of sheets of about 1 1/3 lbs. each, has a total capacity in excess of 4,500 lbs. In this unit the furnaces are located-one under each rack-on adjacent walls as shown in Figure No. 13 (*a*) and not on opposite walls. The detailed arrangement of the furnace in the smoke-house is illustrated in Figure No. 14 (*a*). Particular attention is drawn to the fact that the area of the main wall in the neighbourhood of, and some distance above, the top of the furnace is of stone or road metal and not of the conventional wattle and daub, and it is understood that one or two fires of varying severity have been attributed to failure to insulate the wattle and daub from the furnace by means of a generous section of stone-work. In the original Rambukkande unit provision is made for cadjan roofing together with a ceiling of hessian stitched or nailed to the roof timbers, but in many of the later smoke-houses tagaram roofing has been employed primarily on the grounds of increased permanence and convenience. The original Rambukkande units also carry provision for top ventilation in the form of a small hole about 9″ in diameter near the top of each of two walls.

The behaviour of a typical Rambukkande type smoke-house in the Elpitiya District has been examined in some detail and, as might be expected, there were considerable temperature differences in a horizontal plane at the level of the lower tiers—the areas over the furnaces being at times appreciably hotter than the areas near the corners away from the furnace and in addition the temperatures over the two furnaces were not necessarily identical. The implications here are that a temperature gradient in a vertical plane, *i.e.* with the top tiers 5 to 10°F warmer than the lower ones, cannot necessarily be expected over the furnaces and that, as the units will normally be operated with the wet sheets near the bottom, the use of internal furnaces probably constitutes in this design a distinct fire risk on the grounds that the areas over the furnace openings are obvious 'hot stops' so that accidental overstoking might readily cause the sheets to tear on the reapers and subsequently melt and ignite. In our opinion, therefore, the principal objections to the Rambukkanda smoke-house are the uneven temperature distribution which can be

FIG. NO. 14.

SECTION THROUGH FURNACE

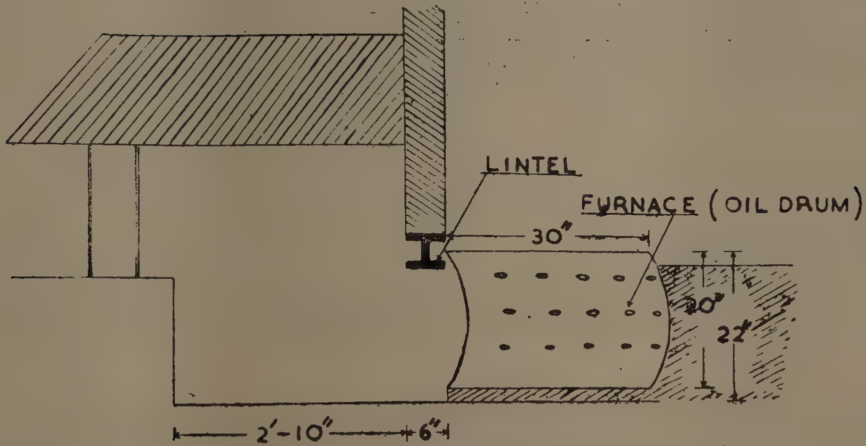


found amongst the lowest tiers and the fire risk resulting from this uneven distribution in conjunction with two internal furnaces.

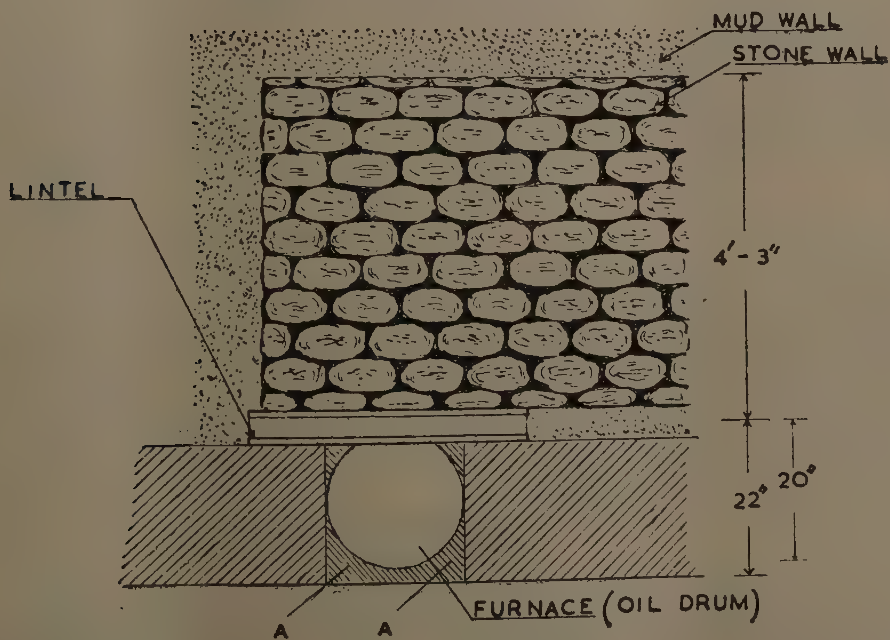
While many Estates appear to be quite prepared to accept the inconveniences and risks involved, it would seem appropriate to consider what is frequently done and what might be done to reduce their significance. Three obvious precautions can and frequently are taken to minimise the fire risk: firstly, very thin wooden reapers and reapers with a sharp or distinct upper 'cutting' edge are not used; secondly, the area of the lowest tier immediately over the furnace is not employed for smoking and drying or, if it is, wet sheets are not placed in this area, and thirdly, 'sheet catchers' can be erected over the furnace and some distance above it in order to catch any sheets which 'pull through' and which might then fall onto the furnace roof or onto a very hot baffle plate close to the surface of the roof. Sheets catchers—wire mesh cages on a framework—are by no means standard equipment in the Rambukkanda type smoke-houses but they have been employed in a limited number of other smoke-houses where there is reason to expect a highly localised heating effect in or amongst the sheets. Various attempts have been made to ensure that the area over the furnaces shall not become unduly hot, and, following our comment that in order to assist in the development of a steady upward draught (and in some cases in order to support combustion of the fuel) provision should be made for air to enter the furnace at the base of the face plate, certain Estates have removed the entire face plate in the expectation of cooling the smoke and hot air without producing too rapid combustion. In our present opinion, the cooling effect required, *i.e.* increased ventilation without a commensurate increase in the combustion rate, might more conveniently and more satisfactorily have been obtained by controlling the air supply to the furnace and by obtaining the extra air by a judicious removal of some of the packing (marked 'A' in Figure No. 14 (*a*)) between the base of the

FIG. NO. 14(A)

SECTION THROUGH FURNACE



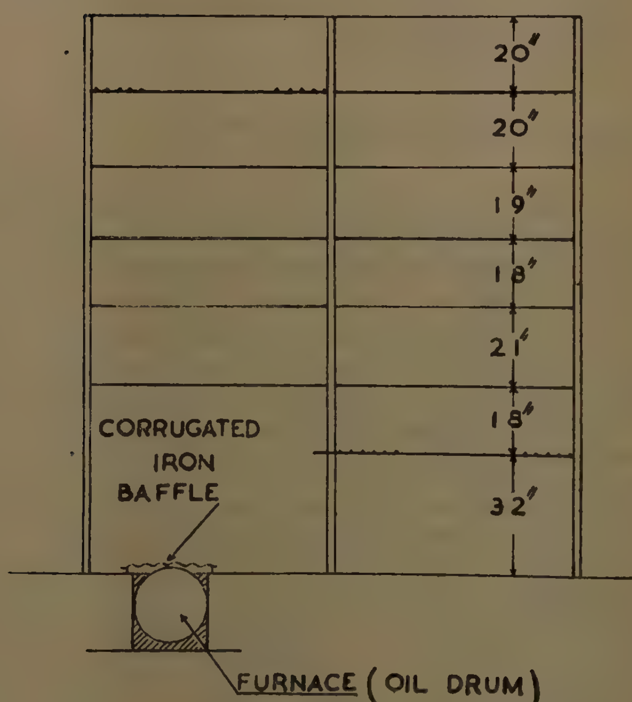
OUTSIDE VIEW OF FURNACE



furnace and the sides of the pit. As far as we are aware this procedure has not yet been tried on smoke-houses in commercial use. While the various comments and suggestions given above may be of some value, it has been suggested that a very substantial reduction in the fire risk and in the unevenness of the temperature gradient can only be achieved by the use of some form of flue system in conjunction with either an outside furnace or a more suitable partially insulated furnace. However Estates which have selected the Rambukkanda design on the basis of a careful balance of cheapness and efficiency are, presumably, not likely to consider the expense of one or more outside furnaces or of lengthy internal underground furnaces cf the Helembe type and upto the present the design implied by Figures No. 16 and 17 has not yet been tested on a commercial scale in Ceylon.

FIG. NO. 15(A)

SIDE ELEVATION OF RACKS



In Figure No. 16 the underground flue system is a modification of the arrangement used at Helembe and is similar to that employed in a limited number of recently renovated permanent type smoke-houses. There is no reason to suppose that the design is unsuitable unless the flues are made too small. The furnace

(Figure No. 17) is an adaptation of a simplified and cheap metal arch type furnace recently used in South India (1) for smoke-houses of capacities in the region of 1,000 lbs. and is built from an old oil drum. The furnace incorporates all the basic features of the conventional metal arch furnace, *e.g.* provision for fire stops, for air to pass into and through the combustion chamber and for additional air to circulate outside the combustion chamber and thence to bulk with the smoke *via* holes cut low down in the rear of the furnace. The bulked air and smoke is led into the main flue by means of a pipe preferably sealed into the back of the furnace as indicated. The furnace as a whole, except the roof, is sunk into a pit and the roof is preferably arched and built from old drums loosely sealed at the joints. While the arrangement illustrated in Figures No. 16 and 17 has not yet been utilised commercially many of the component parts have been tested in other smoke-houses. As in the Helembe design the flue openings in the passage may have to be restricted and are intended to heat the upper tiers of the racks; any tendency to overheating in the lower tiers would be reduced by the judicious use of tagarams. The inclusion of fire stops will reduce the fuel capacity of the furnace, but, if the furnace is found to be too small, the fire stops could probably be removed provided (*a*) the end of the smoke exit pipe inside the furnace is protected with wire mesh to prevent fuel being thrown into the flue, (*b*) the cool air entry vents behind the fire stops are loosely covered and provided (*c*) cool air entry vents are now made at the base of the pipe at the area marked 'V' in Figure No. 17.

To summarize our present views, it will be apparent that in the Rambukkande type smoke-house the problem of how the bulking space in R.R.S. type smoke-houses shall be employed for smoking is solved by the use of a multiple furnace arrangement together with some restriction in the ground surface dimensions, and that, in our present opinion, this solution, as generally adopted commercially, has certain disadvantages of which the more important are the fire risk and the unevenness of the temperature at the level of the lower tiers. However, the importance of these disadvantages, which can in all probability be appreciably minimised as suggested above, and of various minor disadvantages, such as the fact that the furnaces may need replacement annually, can readily be overestimated and there is little doubt that the view, that the Rambukkanda type and its 'double' modification are attractive commercially on the grounds of their relative cheapness, ease of construction and drying efficiency, seems to be substantially justified.

6. Summarizing Discussion:

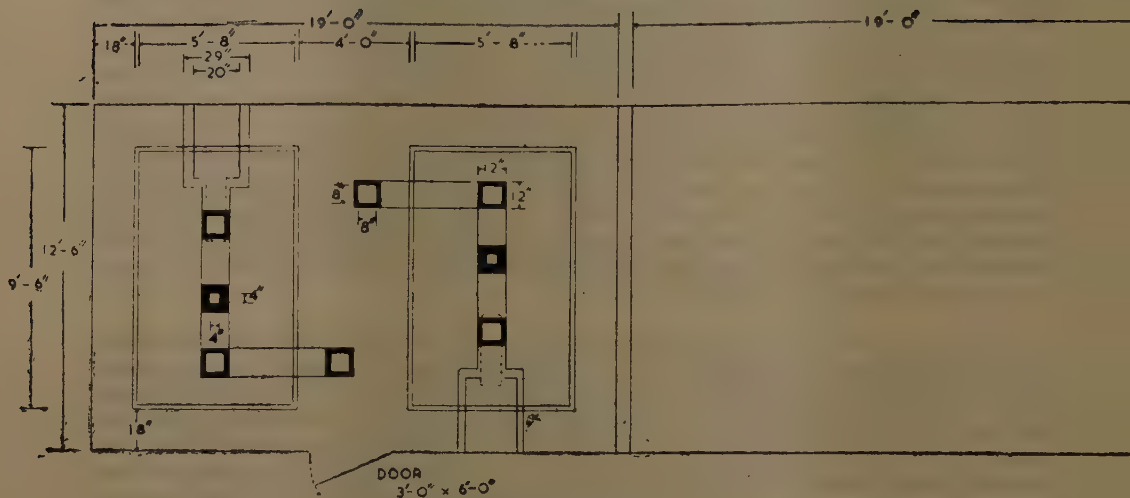
This paper is the first of a series of papers on various aspects of the drying and smoking of R.S.S. and deals with the design and operation of a number of temporary type smoke-houses. One overall object of these papers is to discuss and, perhaps, to present some new information and ideas on how the extra crops obtained from extensive replanting can be processed as R.S.S., and subsequent papers, which will be prepared as time and circumstances permit, are intended to deal with (*a*) the fire risks in smoke-houses, primarily in connection with certain temporary type smoke-houses, (*b*) the construction and operation of tunnel type smoke-houses, (*c*) the factors governing the rate of drying of R.S.S. and/or A.D.S. and with (*d*) recent modifications to multi-storey permanent type smoke-houses.

To those readers who are expecting a clear cut decision concerning which of the contemporary temporary type smoke-houses is the best rather than an indication of where these smoke-houses appear to be defective and some ideas on how to minimise the defects, this paper must be a disappointment as no serious attempt can be nor has been made to answer this question with finality for the obvious reason

MODIFIED DOUBLE RAMBUKKANDA SMOKE-HOUSE

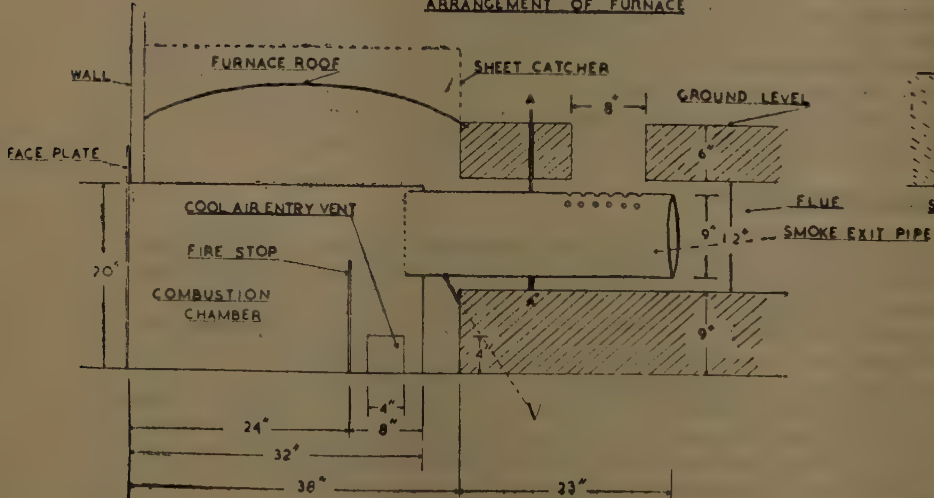
(EXPERIMENTAL)

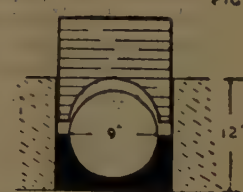
FIG. NO. 16.



ARRANGEMENT OF FURNACE

FIG NO I





SECTION A A'

that conditions and requirements, particularly in the respect of available resources for, and the life requirement of, the smoke-house, can vary. This viewpoint is fully exemplified in one of the earlier sections of the paper, where the circumstances under which these cheap smoke-houses might be or must be an essential feature of factory policy are briefly discussed. Upto the present these smoke-houses have been built mainly by the larger crepe Estates which did not and do not wish to miss the R.S.S. premium on the Colombo market as a result of the agreement with the People's Republic of China. This is not, however, the only condition under which the risks involved with these smoke-houses are worth taking and attention is drawn to the possibility that with extensive replanting the use of these smoke-houses may, for one reason or another, be a worthwhile feature of factory policy of even wholly R.S.S. Estates for varying periods of time.

The Village or Small-holders' smoke-house in Ceylon is usually based on wattle and daub and these constructional materials are employed in the temporary or, more accurately, the semi-permanent smoke-houses recently built by Estates. However, the extent of the 'scaling up' of unmodified Village type smoke-houses for use on Estates with relatively larger crops appears to be limited by structural and technical factors, *e.g.* by (*a*) the absence of sufficient reliable data indicating how large a building with a reasonably permanent roof can be made on a semi-permanent basis from wattle and daub and by (*b*) the internal arrangement of the racks and furnace which generally involves extensive provision for the bulking of hot smoke and cold air. As the individual compartments of most of the recent temporary type smoke-house are, in at least one ground surface dimension, scarcely larger than the R.R.S. 800 lbs. wattle and daub smoke-house, it is logical and, for our purposes, desirable to consider the designs represented by many of these recent temporary type smoke-houses as alternative solutions to the basic problems of how the bulking space in the Village and in the R.R.S. type smoke-houses shall be conveniently used for smoking without a substantial reduction in the ground surface area.

In the unmodified Gallawatte type smoke-house, which incidentally is one of the smoke-houses with the largest smoking chamber, the space reserved for bulking in R.R.S. units is utilised for smoking by a substantial reduction in the level of the lowest tier in the racks together with the employment of an outside furnace with a single central flue opening in the main passage. In our present opinion it is very questionable whether this arrangement can be considered very efficient in terms of the average time taken to dry normal sheets. However, when operated correctly and with care, this smoke-house is quite effective, but the design is not in our opinion the ideal choice for cases where crops are likely to exceed the stated capacity or where 'tight packing' of the sheets will be essential. This smoke-house has the very obvious advantage that the furnace is external rather than internal and could, in our opinion, probably meet the criticisms implied above by the introduction of a number of branch flues possibly with a slight enlargement of the present main flue. In the herring-bone compartment of the Helembe type smoke-house the space reserved for bulking in R.R.S. units is utilised by a substantial reduction in the level of the lowest tiers in the racks together with the employment of an underground furnace and an underground flue network. From the viewpoint of heat distribution this system appears to be entirely satisfactory, implying that under the correct operating conditions sheets will dry rapidly and uniformly. However, this smoke-house is obviously rather expensive to build and careful thought must be given to the materials used in the construction of the furnace and to the operating procedures. In the Rambukkande type smoke-house the height of the lowest tier is reduced in comparison with R.R.S. type units and cheap multiple internal furnaces are employed. While this type of smoke-house is cheap to build, is very popular

commercially and is undoubtedly effective, improvements in the matter of heat distribution and in the reduction of the risk of fires would not, in our opinion, be out of place.

7. Acknowledgements:

Grateful acknowledgement is made to the Proprietors, Agents, Managers, Superintendents and/or Conductors in charge of a large number of Estates, in particular of Gallawatte, Vogan and of Rambukkande, who permitted officers of the R.R.I.C. to inspect their smoke-houses, to certain engineering companies who supplied approximate estimates of the cost of permanent type smoke-houses and to W. I. Pieris, B.A. (Cantab), the S.H.P.O., and to D. S. Muthukuda who offered information on the life expectation of wattle and daub smoke-houses.

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SOME PRELIMINARY COMMENTS ON THE CONTAMINATION OF NATURAL RUBBER BY FUNGICIDAL DUSTS CONTAINING COPPER

By

E. J. Risdon

The background of this subject is given in considerable detail in the Report for 1955, where particular attention was drawn to the fact that the total copper content of latex rubbers, of scraps and of scrap crepe even from undusted areas is not negligible. The practical implication of this observation, from the viewpoint of the contamination obtained as a result of the use of copper-containing fungicidal dusts, is that the degree of contamination must be limited if the resulting rubber is to meet the R.M.A. specification (of not more than 8 parts of copper per million of rubber). The Department's reluctance to accept any suggestion that contamination would necessarily be substantially negligible under normal commercial dusting conditions was explained in detail; but, on the basis of the analytical evidence available at the end of 1955, it was concluded that the degree of contamination might be rather less than expected and the Department was therefore obliged to accept the view that there appeared to be little justification for preventing the careful use of fungicidal dusts containing relatively small amounts of copper on a **restricted experimental** scale. During the period under review the dusting experiment at Dartonfield, commenced in August 1955, has been continued by the Department with dusting about once in every 2 weeks and with sample collection at, usually, every tapping. At the same time an area, adjacent to, but lower down the slope than, this experimental area and into which dust may have drifted, has been sampled at, usually, every tapping for a period of about a year. At the conclusion of this period this 'drift' dusted area has been dusted about once in every two weeks with sampling at, usually, every tapping. A leaflet, No. C/56/1, requesting Agency Houses to ask Estates likely to undertake dusting with copper-containing fungicides to despatch to the R.R.I.C. suitable samples, (details for the preparation and collection of the samples were given in full in the leaflet), from the dusted and control areas was circulated early in the year and an appreciable number of samples collected in connection with this leaflet have been received. The total copper content figures of the approximately 1,680 samples of latex films, latex crepes, scraps and scrap crepe examined upto the end of November 1956, are summarized in the table below:—

Dusting Experiments with Copper Containing Fungicides. 1955-56

Summarizing Table

Row No.	Sample Type	Drawn from (Field Treatment)	Copper Content Readings (p.p.m. on t.s. or d.r.c.)		
			No. of Readings	% above 7.9 p.p.m.	Highest Value
1	Latex Unprocessed t.s. film	Copper Dusted Areas	134	17.9	30
2	—Do—	'Drift' Dusted Areas	86	0.0	7
3	Latex Processed as (*a*) Blanket Crepe	Copper Dusted Areas	239	0.8	13
4	—Do—	'Drift' Dusted Areas	58	0.0	4
5	—Do—	'Control' Areas	68	0.0	3
6	With (*b*) Fraction Crepe	Copper Dusted Areas	78	1.3	39
7	—Do—	'Drift' Dusted Areas	34	0.0	4
8	Scrap Unprocessed (Snap Samples)	Copper Dusted Areas	268	22.0	67
9	—Do—	'Drift' Dusted Areas	172	8.1	11
10	Scraps Processed as Blanket Crepes	Copper Dusted Areas	353	9.1	179(100)
11	—Do—	'Drift' Dusted Areas	99	0.0	7
12	—Do—	'Control' Areas	93	0.0	7

In the table above no attempt has been made to separate the information obtained from the individual and largely incompleted experiments, and although this method of presentation has the advantage of brevity it is, of course, liable to produce a bias in favour of the information obtained from the experiments of which the largest number of samples have been examined. It must also be appreciated that the inherent inaccuracies and the general difficulties in this type of work could mean that the data summarized in the table is representative only of the areas, the types of dust and of the particular procedures involved: however, as the data refer to samples collected from at least six different areas it may be quite reasonable to assume that the individual experiments give an interim picture of the extent of contamination resulting from the use of present day copper-containing fungicidal dusts under certain commercial conditions. On this basis it is concluded that the assumption, that the use of the majority of the present day copper-containing fungicidal dusts against phytophthora leaf disease of rubber in tapping does not raise the copper content of the conventionally processed latex rubbers and of the panel and shell scrap crepes upto and above the upper limit specified by the R.M.A., does not apply under many Ceylon conditions. This is particularly obvious in the case of scrap crepes (*vide* Rows No. 10—12 of the table) where two samples contained sufficient copper to be tacky at the time of analysis—about four weeks after collection. In the case of latex crepes (*vide* Rows No. 3—7 of the table) the extent of contamination would appear to be of lower order but, nevertheless, not negligible. In the latter connection it will be noted that there is evidence that the copper content of latex obtained from dusted areas is liable to be higher than the copper content of latex drawn from areas into which the dust may have drifted by accident, and that, although much of the copper is removed in processing as crepes, the final values can be above 8 p.p.m. (the relevant data are included in Rows No. 1—7 of the table).

It is to be expected that under normal conditions the major source of contamination will be either or both of (*a*) imperfect dusting techniques, *i.e.* dusting in such a way that appreciable dust fails to reach the canopy or is readily reflected back by the canopy, and (*b*) natural leaching of the dust from the leaves and bark onto the panel and into the shell. Upto the present the small scale experiments specifically designed to test the above and other assumptions concerning the methods by which contamination can, or may reasonably be expected to, take place have given clear indications that:—

(*a*) All the commercial and experimental dusts examined to-date—including some dusts containing a 'sticker'—are at least partially washed off the surface of the leaves by artificial or natural means.

(*b*) Under particularly adverse conditions of artificial leaching when a tapping is in progress, the copper content of the partially washed out latex can rise to a figure above 500 p.p.m. on the total solids. Under these conditions the scraps obtained on the subsequent tapping are, of course, high in copper.

(*c*) Incorrect dusting, in particular stationary spot dusting with the nozzle pointing slightly lower than usual, can raise the copper content of the scraps drawn at the subsequent tapping.

While the experiments mentioned above cannot yet be regarded as completed, it is difficult, even at this stage, to avoid the conclusion that under normal commercial conditions leaching by rain will, in fact, be a major source of contamination. Thus, of the high copper content latex crepes included in Rows No. 3 and 6 of the table all but one—for which the necessary data is unfortunately not available—can be explained on the basis of partial washouts during tapping, if it is assumed that when the latex contains appreciable copper dust much of this dust is preferentially removed with the fraction or alternatively is not necessarily readily milled out of the fraction. The information at present available on the contamination of scraps and scrap crepes does not suggest that the extent of contamination is necessarily solely governed by the incidence of partial washouts, and in this connection it should be noted that (*a*) the proportion of copper removed from scraps during normal processing is probably appreciably lower than that removed in the conventional latex crepes process and that (*b*) in very heavy monsoon showers the extent of contamination by leaching onto dry or partially dried scraps in the field might be quite small. Subsidiary experiments carried out at the same time as those mentioned above appear to suggest that when dusting is carried out in the vicinity of the factory the windows of the lofts should be closed, and that, if dusting is delayed or prolonged until the time of collection and delivery of latex, then open vessels, *e.g.* buckets, containing latex should not be allowed to pass near the dusting machine.

The data summarized above strongly suggests that some degree of contamination is liable to occur when copper-containing fungicidal dusts are employed during the 'phytophthora season' on areas of rubber in tapping. As the information at present available does not yet permit us to suggest how all the extra copper can be satisfactorily removed or inactivated at the producer's factory, it would **at present** appear that, unless consumers indicate that they are prepared to tolerate copper contents appreciably above the R.M.A. specification limit, the minimum precautions necessary for the successful use of dusts must probably include at least the following: (*a*) the areas dusted must be restricted as far as possible (*vide* f), (*b*) the quantity of dust used and the copper content of the dust should follow the recommendations of the R.R.I.C., in particular heavy dusting rates and the generous use of dusts which are very high in copper should be limited to small experimental

areas only, (*c*) the dusting should be carried out according to conventional procedures with, if possible, the shells inverted (*i.e.* top downwards), and practices such as stationary spot dusting and testing a stationary machine inside mature rubber areas should be prohibited, (*d*) dusting should not be carried out on the day of tapping, (*e*) latex collected from dusted areas during partial washouts should be discarded, (*f*) stable latex collected from dusted areas during dry weather should not be bulked separately but should be added to, and well mixed with, the much larger main bulk to ensure dilution with much latex from untreated areas and (*g*) all scraps and all cup lumps from dusted areas (and, unless the dilution implied by (*f*) is large and the latex uniformly stable, all first fraction also) should be discarded and burnt, particular care being taken to ensure that tappers do not take advantage of this apparent wastage of scrap etc. to augment their income by retaining the scraps themselves. As it may well be difficult to ensure that contaminated latex crepes and scraps etc. do not reach dealers and remillers, where they will probably be regraded on the basis of visual appearance rather than technological behaviour, it might at this stage be most appropriate to take the areas requiring dusting with copper-containing fungicides out of conventional tapping during this dusting season.

Due to the inherent inaccuracy of the analytical and sampling procedures etc. (*vide* supra) several protracted attempts have been made to develop an indirect but relatively reliable method of assessing the active copper content of prepared natural rubbers, but upto the present these attempts have not been an unqualified success. Briefly, much of the difficulty would appear to be due to the fact that the samples of raw rubber used showed marked difference in their resistance to accelerated (oven) ageing tests in the absence of copper and in their behaviour in the presence of added copper. Nevertheless, these tests do not indicate that the copper used in fungicidal dusts can be regarded as technologically inactive and tests of this nature have been used to obtain a confirmatory indication of whether a number of the samples included in the figures in the table above are in fact not very high in copper. It is hoped that further attention can be given to this subject at a later date.

Estimations, on behalf of the Plant Pathologist, of the copper on the surface of leaves dusted by the Plant Pathologist (*a*) when dry and (*b*) when wet indicated that with the majority of the conventional dusts wet leaves retain much more copper than dry leaves. As the work summarized above probably gives an adequate interim picture of the extent of contamination (in the absence of effective rainguards) of latex, latex crepes, scraps and scrap crepes under certain Ceylon conditions when conventional commercial fungicidal dusts based upon copper are employed, it is proposed during 1957 to give further attention to (*a*) the mechanism of scrap contamination, (*b*) the possibilities of rainguards and of improved 'stickers' and to (*c*) methods of removing or inactivating copper in dry rubber or latex. It is anticipated that the long term dusting experiments at Dartonfield will be continued with relevant modifications.

Note by Editor.—This contribution to this Journal has been taken, with only minor amendments, from the draft Annual Report of the Rubber Research Institute, for 1956. It was circulated in February, 1957, as Leaflet No. C/57/2, to Agency Houses and certain Estates with a request, Leaflet No. C/57/1, for the supply of additional relevant samples and information during 1957. It is now reproduced in this Journal to ensure wider circulation. Acknowledgement is made to the Proprietors, Agents and Managers of the commercial Estates which kindly supplied relevant samples in 1955 and 1956, to Mr. M. Nadarajah, Research Assistant, and Mr. T. S. Nathan, Technical Assistant who carried out the individual analysis and to Mr. M. T. Veerabangsa, Technical Assistant, who carried out the major portion of the dusting and sample collection at Dartonfield.

A COMPARISON OF FORMS OF NITROGEN MANURING

By

D. H. Constable

Amongst the manurial trials which have been in progress there have been some aimed at comparing Sulphate of Ammonia and Nitrate of Soda as sources of nitrogen for use by Hevea.

Unfortunately some trouble was experienced with these trials. Of the original three experiments one was on a nitrogen rich soil and one was invalidated by rat damage. The remaining experiment was reported on in our Bulletin No. 55.

Two more experiments were opened on nitrogen deficient soils but one has been lost to the Institute by sale of the property and the results of the remaining experiment are given here together with those of the original surviving experiment.

The later experiment was on Degalessa on which a 30% nitrogen growth effect had already been demonstrated. The trial in which this effect had been shown was terminated at a relatively early stage to avoid excessive set back to the plants in the manurial deficient treatments. It was therefore decided to carry on the trial in a modified form by using the two forms of Nitrogen fertiliser on the P and PK plots of the original trial.

Tables 1, 2 and 3 therefore contain the detailed girth figures for plots in 1953 and 1954 when the original trial was in progress and in 1955 after abandonment of the original trial and substitution of two forms of N manuring to the P and PK plots. Table 4 contains the average yearly girth increments from the original experiment and from the P and PK plots of the modified experiment.

Table 5 gives the individual plot girth increments for the two forms of nitrogen and Table 6 gives the corresponding figures for Mirishena Estate. *In neither case is there a significant difference in growth between the sulphate of ammonia and nitrate of soda treatments.*

A second important effect can be noted in the Degalessa figures of Tables 2 and 4. NPK manuring has given 8.81 inches growth as compared with 6.57 inches for Phosphate only manuring, a difference of 2¼ inches. Also the yearly increment with NPK manuring is 3.33 inches. Now the use of **high** nitrogen manuring in 1954—55 has put up the girth increment on P and PK to an average 4 inches or 2/3 inch more than **normal** NPK manuring.

It is therefore possible by remedial manuring to overcome some of the effects of a bad start.

However, it should also be noted that a leeway of 2¼ inches has to be made up at the rate of 2/3 inch per year which will take 3—4 years and requires (in this case) nitrogen manuring of at least double the usual rates. Obviously therefore it is neither economic nor wise to cut down on the manuring programme with regard to immature plants.

Conclusions:

(1) At equivalent nitrogen rates *Sodium Nitrate is equally as effective as Sulphate of Ammonia for immature Hevea.

(2) Heavy nitrogen manuring (on an N-deficient soil) can partially overcome the ill effects of early under-manuring. In this respect either ammonia or nitrate is equally effective.

(3) Restorative manuring is unlikely to prove economic or satisfactory as compared with an original full NPK manuring programme.

Acknowledgements:

We have to thank the Chilean Nitrate Corporation for the gift of generous quantities of Sodium Nitrate for these experiments.

Also Messrs. H. L. Rogers and W. S. Veitch of Degalessa Group and Mr. E. C. K. Minor of Mirishena Group for their co-operation in running these trials.

* **Note.**—5 ozs. of Sodium Nitrate were used for every 4 ozs. of Ammonium Sulphate in these experiments.

Table I

Degalessa Manurial Trial

Girths in inches 1953

Block	1	2	3	4	Average
O	... 4.75	4.53	4.55	4.77	4.65 ± .071
P	... 4.89	4.48	4.63	4.69	4.67
NP	... 5.02	5.19	5.38	5.40	5.25*
PK	... 4.65	4.62	4.81	4.64	4.68
NPK	... 5.59	5.31	5.55	5.45	5.48*

N_0 = 4.67 N_1 = 5.36   N effect = .69 inches

Table II

Degalessa Manurial Trial

Girths in Inches 1954

Block	1	2	3	4	Average
O	... 5.64	5.40	6.07	6.36	5.86 ± .28
P	... 7.21	6.54	6.04	6.52	6.57
NP	... 6.95	8.66	7.98	7.82	7.85
PK	... 7.17	6.45	6.76	6.01	6.60
NPK	... 9.28	9.12	8.32	8.53	8.81

N_0 = 6.58 N_1 = 8.33   N effect = 1.75 inches

Table III

Degalessa revised Manurial Trial

Girths in inches 1955

Block		1	2	3	4	Average
P	NH_4	... 11.8	10.2	9.7	10.6	10.55
	NO_3	... 12.0	11.9	9.3	10.5	10.95
PK	NH_4	... 11.6	10.2	10.4	8.4	10.15
	NO_3	... 11.5	10.4	11.4	8.5	10.45

Average NH_4 = 10.35 inches

" NO_3 = 10.70 inches

Table IV

Degalessa original and revised Manurial Trials

Girth differences in inches 1953—54 and 1954—55

		1953—54	1954—55
O	...	1.21"	—
P	...	1.90	4.18"
NP	...	2.60	—
PK	...	1.92	3.70
NPK	...	3.33	—

Table V

Degalessa revised Manurial Trial

Girth increments in inches 1954—55

Block			1	2	3	4	Average
P	+	NH_4	... 4.6	3.7	3.7	4.1	4.05
	+	NO_3	... 4.8	5.4	3.3	4.0	4.38
PK	+	NH_4	... 4.4	3.7	3.6	2.4	3.50
	+	NO_3	... 4.3	3.9	4.6	2.5	3.80

Average NH_4 = 3.78 ± .24 inches

,, NO_3 = 4.09 ± .24 inches

Table VI

Mirishena Manurial Trial

Girths in inches 1954 (Two years girth)

Block			1	2	3	4	Average
P	+	NH_4	... 7.99	6.90	7.27	7.30	7.37
		NO_3	... 7.79	7.50	7.00	6.48	7.19
PK	+	NH_4	... 8.09	7.64	8.25	6.67	7.66
		NO_3	... 7.76	7.69	7.77	7.40	7.64

Average NH_4 = 7.51 inches

,, NO_3 = 7.41 inches

RUBBER RESEARCH INSTITUTE OF CEYLON

Minutes of the 148th meeting of the Rubber Research Board held at the Board Room of the Rubber Controller's Office, Eastern Bank Building, Fort, Colombo, at 2-30 p.m. on Friday, 22nd February, 1957.

Present.—Mr. S. Pathmanathan (in the Chair), Senator Thomas Amarasuriya, O.B.E., Mr. W. P. H. Dias, J.P., Mr. G. H. Dulling, Mr. Errol A. Jayawickrema, J.P. U.M., Mr. V. T. G. Karunaratne, M.P., Mr. B. Mahadeva (Rubber Controller), Mr. R. H. Wickremasinghe M.B.E., C.C.S. (Deputy Secretary to the Treasury), Dr. E. D. C. Baptiste, (Director) and Mr. C. D. de Fonseka (Administrative Secretary).

An apology for absence was received from Dr. M. F. Chandraratne, Director of Agriculture.

1. Board:

Changes in membership—The Chairman reported that:—

(*a*) Mr. G. H. Dulling had returned from leave and resumed membership with effect from 27-12-56 relieving Mr. R. C. L. Notley, who had acted for him.

(*b*) Mr. R. H. Wickremasinghe had returned from leave and resumed membership with effect from 28th January, 1957, relieving Mr. H. S. Amerasinghe, who had acted for him.

2. Minutes:

Draft minutes of the meeting held on 19th December, 1956, which had been circulated to members, were signed by the Chairman.

3. Administrative Committee:

The recommendations made by the Committee at its meeting of 13th February 1957 were approved.

4. Smallholdings Committee:

As recommended by the Committee at its meeting held on 13th February 1957, the appointment of Messrs. G. W. Jayawardane, J. C. Illangantileke, P. Thiviyanayagam and P. Wijeykoon as Temporary Rubber Instructors was approved.

5. Accounts:

Receipts and Payments Account for the 4th Quarter 1956 was approved.

6. Staff:

Changes in staff since the last meeting and loans granted to staff for purchase of transport were reported and approved.

7. Publications:

The following publications were tabled:—

Smallholdings Folder	No. 1	White Root Disease of Rubber.
,, ,,	No. 2	Pink Disease of Rubber.
,, ,,	No. 3	Bark Cracking in PB 86 (in Sinhalese).

8. Next Meeting:

It was agreed that the next meeting of the Board be held at 2-30 p.m. on Thursday, 28th March, 1957.

9. Exchange of Clones:

The Director reported recent correspondence in connection with the proposed exchange of clones with the United States Department of Agriculture, Beltsville, Maryland, U.S.A.

The meeting then terminated.

RUBBER RESEARCH INSTITUTE OF CEYLON

Minutes of the 149th meeting of the Rubber Research Board held in the Board Room of the Rubber Controller's Office, Eastern Bank Building, Fort, Colombo, at 2-30 p.m. on Thursday, 28th March, 1957.

Present:—Mr. S. Pathmanathan (in the Chair), Mr. G. H. Carter, Dr. M. F. Chandraratne (Director of Agriculture), Mr. W. P. H. Dias, J.P., Mr. G. H. Dulling, Mr. Errol A. Jayawickrema, J.P., U.M., Mr. V. T. G. Karunaratne, M.P., Mr. B. Mahadeva (Rubber Controller), Dr. E. D. C. Baptiste (Director) and Mr. C. D. de Fonseka (Administrative Secretary).

An apology for absence was received from Senator Thomas Amarasuriya, O.B.E.

1. Board:

The Chairman reported that Mr. G. H. Carter had been re-nominated to represent the Planters' Association of Ceylon for three years from 1st April, 1957.

2. Minutes:

Draft minutes of the meeting held on 22nd February, 1957, which had been circulated to members, were signed by the Chairman.

3. Reports and Accounts:

(*a*) *Chairman's and Director's reports for* 1956—These were approved and it was agreed that they be printed under the title "Annual Report of the Rubber Research Institute of Ceylon, 1956."

(*b*) *Balance Sheet and End of Year Accounts for* 1956—were approved subject to audit.

4. Staff:

(*a*) *Smallholdings Propaganda Officer*—In view of a recommendation made by the Director and agreed to by the S.H.P.O. it was agreed that the designation Smallholdings Propaganda Officer be changed to Smallholdings Advisory Officer.

(*b*) *Assistant Staff*—Changes in Asst. Staff since the last meeting were reported and approved.

5. RLD Clones:

In view of a recommendation made by the Director, it was agreed that RLD clones should in future be known as RRIC clones.

6. Medical facilities at Hedigalla Experiment Station:

In view of the increase in the resident labour force at Hedigalla it was agreed that an Asst. Dispenser be stationed at Hedigalla.

The meeting terminated at 3-30 p.m.

RUBBER RESEARCH INSTITUTE OF CEYLON

Minutes of the 150th meeting of the Rubber Research Board held in the Board Room of the Rubber Controller's Office, Eastern Bank Building, Fort, Colombo, at 2-30 p.m. on Tuesday, 28th May, 1957.

Present:—Mr. S. Pathmanathan (in the Chair), Mr. G. H. Carter, Dr. M. F. Chandraratne (Director of Agriculture), Mr. W. P. H. Dias, J.P., Mr. G. H. Dulling, Mr. V. T. G. Karunaratne, M.P., Mr. R. H. Wickremasinghe, M.B.E., Dr. E. D. C. Baptiste (Director) and Mr. C. D. de Fonseka (Administrative Secretary).

Apologies for absence were received from Senator Thomas Amarasuriya, O.B.E., Mr. Errol A. Jayawickrema, J.P., U.M., and Mr. B. Mahadeva, C.C.S. (Rubber Controller).

1. Minutes:

Confirmation—Draft minutes of the meeting held on 28th March, 1957, which had been circulated to members, were signed by the Chairman.

2. Administrative Committee:

The recommendations made by the Committee at its meeting held on 15th May, 1957, were approved subject to the following amendments:—

(*a*) *Terms of service of overseas officers*—The recommendation that the period of contract of overseas officers be reduced to 2 years followed by 4 months leave (instead of 3 years followed by 6 months leave) at the option of the officers concerned was approved, and it was agreed that officers should be required to declare their option at least 6 months prior to the termination of the previous contract.

(*b*) *Budwood of RRIC Clones*—The suggestion made by a member that small quantities of budwood of RRIC Clones be issued free of charge to estates was not approved.

3. Accounts:

(*a*) *Receipts and Payments Account for the 1st Quarter* 1957—was approved subject to the correction that on page 2 'Sundry Debtors 1955' should read as 'Sundry Debtors 1956.'

(*b*) *R.R.I.C. Co-operative Store*—Agreed that 50% of the balance of the loan due from the Co-operative Store (*i.e.* Rs. 388.70) be waived.

4. Staff:

(*a*) i. *Botanist*—The Chairman reported that Mr. C. A. de Silva, Botanist, had returned from leave and resumed duties on 20-5-57.

ii. *Assistant Advisory Officer, Smallholdings Dept.*—The Chairman reported that Mr. H. H. Peiris, A.A.O. (South), had returned from leave and resumed duties on 2-5-57.

iii. *Technical Assistant, Plant Pathology Dept.*—It was reported that Mr. H. L. Munasinghe, Technical Assistant, Plant Patho. Dept., who had gone to the Waite Agricultural Research Institute, Adelaide, had completed his training and returned to the service of the Institute on 7-5-57.

(*b*) *Research Asst., Agro. Dept.*—Agreed that Mr. A. J. Jeevaratnam, Research Assistant, Agronomy Department, be promoted to the post of Assistant Agronomist with effect from 1st January, 1957.

(*c*) *Assistant Staff*—Changes in staff since the last meeting were reported.

5. General Items:

(*a*) *May Day*—It was reported that May Day had been declared a holiday for the Institute's Staff.

(*b*) *Salary advance for Buddha Jayanti*—The Chairman reported that in accordance with government practice an advance of a half month's basic salary or Rs. 50/- whichever is the greater had been granted to the members of the Assistant and Minor Staff for the celebration of Buddha Jayanti. This was approved and it was agreed that the advance be recovered in ten monthly instalments starting in June, 1957.

(*c*) *Assistant Staff Medical Fund*—It was agreed that the Assistant Staff Medical Fund should in future be administered by a Committee consisting of:—

The Director
The Administrative Secretary and
One member of the Asst. Staff.

6. Next Meeting:

It was agreed that the next meeting of the Board be held at 2-30 p.m. on Monday, 15th July, 1957.

The meeting terminated with a vote of thanks to the Chair, proposed by Mr. W. P. H. Dias.

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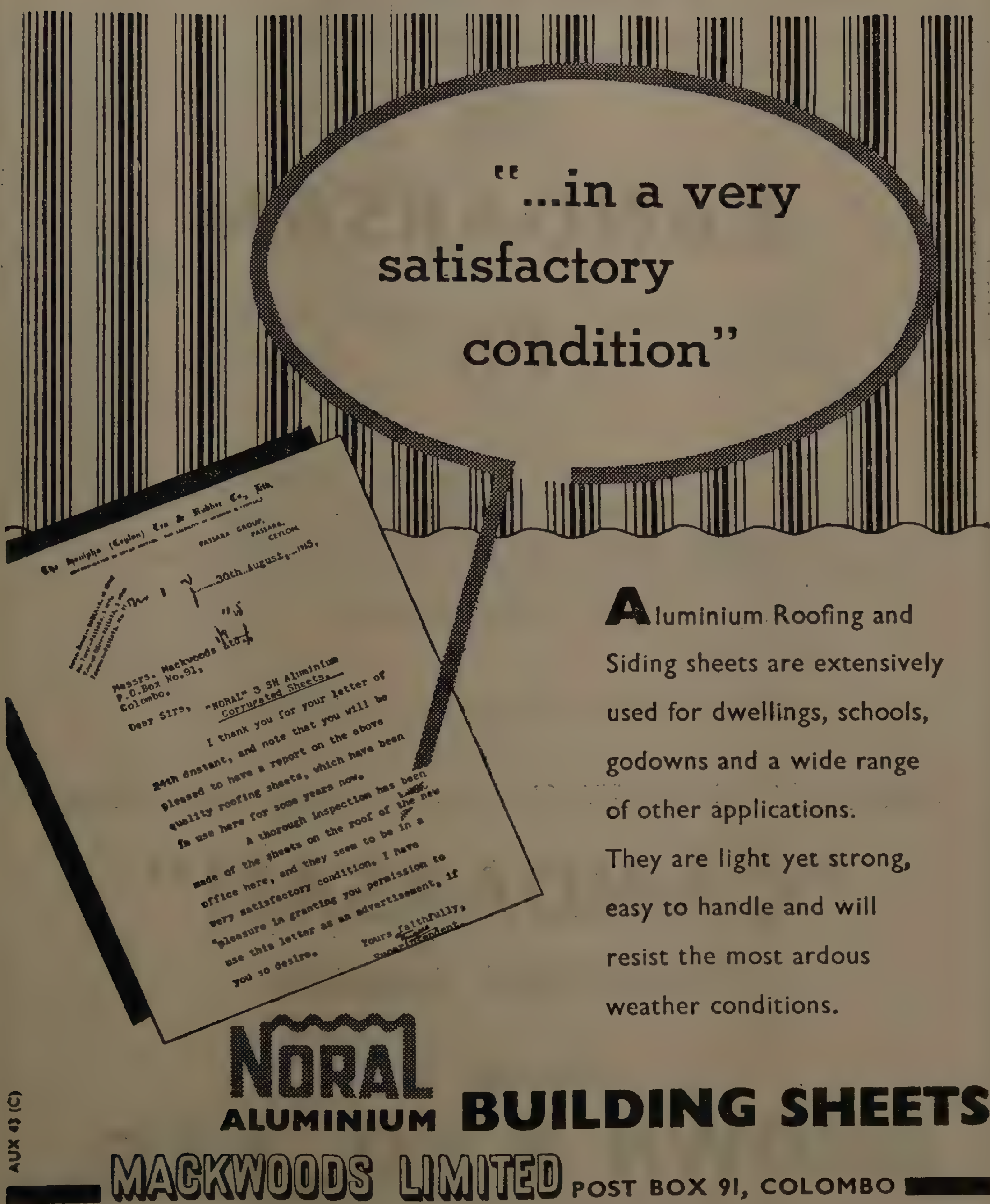
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Dear Sirs, "NORAL" 3 SH Aluminium Corrugated Sheets.
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RUBBER RESEARCH INSTITUTE OF CEYLON

STAFF

Director	... E. D. C. Baptiste, Ph.D. (Lond.), M.Sc., A.R.C.S., D.I.C., F.I.R.I.
Chemistry Department	
Chemist	... E. J. Risdon, M.A., D.Phil., F.R.I.C.
Research Assistant	... M. Nadarajah, B.Sc.
Senior Technical Assistant	... D. S. Muthukuda.
Technical Assistants	... T. S. Nathan, M.T. Veerabangsa and G. G. Gnanasegaram.
Botany Department	
Botanist	... C. A. de Silva, B.Sc., C.D.A.
Assistant Plant Breeder	... D. M. Fernando, M.Sc.
Research Assistant	... L. B. Chandrasekera, B.Sc.
Computer	... W. G. V. Fernando.
Technical Assistant	... C. Amaracone.
Plant Pathology Department	
Plant Pathologist	... A. Riggenbach, Dipl. Sc. Nat (ETH), Dr. Sc. Nat (ETH).
Assistant Plant Pathologist	... O. S. Peries, B.Sc.Agr.
Technical Assistants	... H. L. Munasinghe, E. G. Mendis, T. Marcus Fernando, and L. T. Jayaweera,
Agronomy Department	
Agronomist	... D. H. Constable, M.Sc., D.I.C.,A.R.C.S.
Assistant Agronomist	... A. J. Jeevaratnam, M.Ag.Sci.
Senior Technical Assistant	... T. Kanthasamy.
Technical Assistants	... A. K. Gunadasa, U.K.D. Lewis. and E. R. Chelliah
Estate Department	
Superintendent	... L. Wijeyegunawardena.
Hedigalla Nursery Manager	... H. M. Buultjens.
Senior Field Assistants	... D. C. Kannangara, and L. P. de Mel
Head Estate Clerk	... T. S. J. Peiris.
Senior Artisan	... T. C. Fernando.
Clerks (5)	
Rubber Maker, Apothecary, Electrician and Workshop-Foreman.	
Field Assistants (7)	
Smallholdings Department	
Smallholdings Advisory Officer	... R. T. Wijewantha, B.Sc. (Special) Hons.
Assistant Advisory Officers	... N. W. Palihawadana, K. Wilson de Silva and H. H. Peiris.
District Field Officers	... D. R. Ranwala, P. S. G. Cooray, D. E. A. Abeywickrema and B. D. Pedrick.
Rubber Instructors (45)	
Clerks (6)	
Administration	
Administrative Secretary	... C. D. de Fonseka, A.C.C.A., A.C.C.S.
Office Assistant	... J. A. Attygalle.
Personal Assistant to the Director	... Miss. E. R. M. Flynn.
Senior Accounts Clerk	... H. Kulasena, A.C.C.S.
Clerks (9), *Clerk-Librarian and Storekeeper*	

Note.—The Laboratories and Head Quarters Offices of the Institute are situated at Dartonfield Estate, Agalawatta, Telephone No. 26, Agalawatta, Telegraphic Address 'Rubrs' Agalawatta. There are two Experimental Stations, one at Nivitigalakele, Matugama, and the other at Hedigalla, Latpandura. The Office of the Smallholdings Department is at No. 33, Clifford Place, Colombo 4. Telephone No. 84205, Colombo.

All enquiries and other communications should be addressed to the Director, Rubber Research Institute of Ceylon, Agalawatta.